LCP CHEMICALS, INC. SUPERFUND SITE

NEXUS SUMMARY FOR GAF CORPORATION/G-I HOLDINGS, INC.

Introduction

GAF Corporation, through its successor, G-I Holdings, Inc., (all corporate predecessors are herein referred to as "GAF") is liable as (1) the owner of the LCP Site at the time of disposal of hazardous substances, see 42 U.S.C. § 9607(a)(2); (2) an operator of the LCP Site at the time of disposal of hazardous substances, see 42 U.S.C. § 9607(a)(2); and (3) a person who arranged for disposal of hazardous substances at the LCP Site, see 42 U.S.C. § 9607(a)(3). GAF owned and conducted operations at the LCP Site from 1965 through 1972. Prior to that period, from 1955 through 1965, the United States operated GAF's business after seizing the company's assets during World War II.

Corporate History

American I.G. Chemical Corporation was formed in 1929 as a result of the merger of General Aniline Works, Inc. (formerly known as Grasselli Dyestuff Corporation) and several other American companies owned by the German chemical company I.G. Farben. The company's name was changed to General Aniline & Film Corporation in 1939. It was seized by the United States government in February 1942 under the Trading with the Enemy Act because of its affiliation with I.G. Farben. It operated under government control until 1965, when the government sold the stock of the company to a group of private investors. The company changed its name to GAF Corporation in 1968.[1]

[1] Robert J. Baptista & Anthony S. Travis, *I.G. Farben in America: The Technologies of General Aniline & Film*, 22 History & Technology (2006) ("Baptista & Travis") (Exhibit A) at 187, 194-213; Certification of Leonard P. Pasculli ("Pasculli Certif.") (Exhibit B) ¶¶ 1-4; GAF Corporation History (Exhibit C) at 1-3; Brown & Caldwell, Remedial Investigation Report, LCP Chemicals, Inc. Superfund Site, Linden, New Jersey (July 2013) ("RIR") (July 2013) (Exhibit D) at 1-3; Vesting Order No. 1 Relating to Shares of Stock of the General Aniline & Film Corp., of Delaware, 7 Fed. Reg. 3148 (April 30, 1942) (Exhibit E).

In 1986, GAF Corporation formed two subsidiaries, GAF Chemicals Corporation and GAF Building Materials Corporation. GAF Chemicals Corporation received the assets of GAF Corporation's former Chemicals Division. Following the acquisition of GAF Corporation by a group of investors headed by Samuel Heyman, Heyman formed a new GAF Corporation (which held the stock of the original GAF Corporation), and formed two new GAF subsidiaries, including G-I Holdings, Inc.[2]

G-I Holdings, Inc. is the successor to GAF Corporation. G-I Holdings filed for bankruptcy in 2001, and emerged from bankruptcy in 2009. Within its Statement of Financial Affairs ("SOFA") filed in 2001, and also its Amended SOFA filed in 2008, G-I Holdings was required to list all sites for which it received a notice of potential liability from a governmental unit. In listing the LCP Site within its response, G-I Holdings has acknowledged that it is the successor to the GAF entity(s) that would have received such notice, and is therefore the successor to GAF with respect to the LCP Site.[3]

Ownership

GAF acquired the LCP Site in several steps. Grasselli Dyestuff Corporation, a corporate predecessor of GAF Corporation, owned much of the land in the Tremley Point area since its formation in 1924. GAF Corporation (then known as General Aniline & Film Corporation) also acquired portions of the LCP Site from E.I. Du Pont de Nemours and Company in 1942, 1949, and 1963.[4]

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[2] GAF Corporation History at 4; Baptista & Travis at 217.

[3] Form 7 - Statement of Financial Affairs (filed on April 2, 2001) (Exhibit I) at pg. 9 of 207, and pg. 194 of 207; Attachment 17A (filed on September 19, 2008) (Exhibit J) at pg. 3 of 7.

[4] RIR (Exhibit D) 1-2 to 1-3, Table 1-1, & App. A.

Operations, Waste Disposal and Surface Water Discharges

GAF conducted operations at the LCP Site between 1955 and 1972. For the first ten years of that period (1955-1965), the company was controlled by the United States government.[5] The GAF operations included a chlor-alkali (chlorine manufacturing) plant, with a mercury-cell chlorine process area, a hydrogen gas processing plant, and a sodium hypochlorite manufacturing area. The plant, which was constructed during the period of the government's ownership and operation of the LCP Site, had a capacity of fifty tons per day.[6]

The mercury cell system split sodium chloride (salt) to produce chlorine gas, passing an electric current through a salt solution (brine) between a graphite anode and a mercury cathode to produce chlorine gas and sodium. The sodium dissolved into the mercury, and the sodium-mercury mixture reacted with water to produce sodium hydroxide (caustic soda) and hydrogen gas. All materials from this process, including the spent brine, hydrogen gas, and sodium hydroxide, were contaminated with mercury, which had to be removed from the useful products. In particular, the mercury-sodium mixture was hydrolyzed to form elemental mercury, a sodium hydroxide solution, and hydrogen gas.[7]

The brine used in the chlorine production process was purified in a precipitation process that produced a brine mud or "sludge." In 1962, GAF constructed a lagoon into which the brine sludge was disposed. Prior to that time, process waste was treated and discharged to South Branch Creek via a drainage swale across the LCP Site. When it sold the Site to LCP in 1972,

[5] As set forth in a separate nexus summary submitted by counsel for Praxair, the United States is also liable for response costs because of its status as an owner and operator at the time of disposal of hazardous substances.

[6] Baptista & Travis (Exhibit A) at 202, 213; 1955 Annual Report (Exhibit F) at 4.

[7] RIR (Exhibit D) at 1-4 to 1-5; URS Corporation, Final Work Plan, Remedial Investigation and Feasibility Study for the LCP Chemicals, Inc. Superfund Site, Linden, New Jersey (April 12, 2001) ("RI/FS Work Plan") (Exhibit G) at 1-1, 1-7; Site Summaries (Exhibits N and O).

GAF took back an easement to the drainage ditch on the LCP Site and continued to discharge waste water and hazardous substances into the swale on the LCP Site.[8] Supernatant from the lagoon was also treated and discharged to South Branch Creek. GAF used the lagoon until it halted chlorine production in 1971.[9]

Conclusion

GAF owned and operated at the LCP Site while disposal of hazardous substances took place there, and also arranged for the disposal of hazardous substances. GAF's operations likely contributed a significant amount of the mercury contamination at the LCP Site. It is therefore a potentially responsible party under CERCLA, and should be issued a General Notice Letter and be required to contribute toward the investigation and cleanup of the LCP Site.

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[8] Eckenfelder Inc., Remedial Investigation Report (September 20, 1991) (Exhibit K) at pg. 2-3, 2-20 and 2-21; RIR (Exhibit D) at Appendix A; Agreement for Discharge into Flume and Outfall Ditch (August 24, 1972) (Exhibit L); Brown and Caldwell, Historic Drainage Analysis - LCP Chemicals Inc. Superfund Site (Revised 2006) (Exhibit M) at pg. 8, and Figure 1-1 through 2-28.

[9] RI/FS Work Plan (Exhibit G) at 1-1, 1-7, 1-11; Eder Associates, Description of Current Conditions, RCRA Facility Investigation Task I (January 1992) (Exhibit H) at 17, 19.

Exhibit A

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I. G. Farben in America: The Technologies of General Aniline & Film

Robert J. Baptista and Anthony S. Travis

The modern US chemical industry emerged during World War I in response to shortages of essential organic chemicals previously available mainly from Germany. This stimulated the development of technologies based on complex aromatic chemistry. The outcome was an advanced science-based industry that embarked on diversification during the 1920s. However, access to German innovations was still needed and the Germans wished to regain dye markets lost during the war. This led to a singularly important merging of American and German interests, the General Aniline Works, later known as General Aniline & Film. Under German ownership in the 1930s, a unique strategy for control of production and research was implemented at General Aniline. Under US government ownership from 1942, General Aniline engaged in diversification based on pre-war German innovations. The cessation of dyestuff manufacture in the 1970s at what had become the GAF Corporation represented a break with the past that was also taking place elsewhere in the USA. A half a century after its foundation the classical organic chemical industry had become an anachronism.

Keywords: Grasselli Chemical Company; I. G. Farben; General Aniline & Film; Technology Transfer; Dyes; Diversification; Reppe Chemistry

Introduction

In July 1977, the US chemical concern known as the GAF Corporation, formerly General Aniline & Film, announced plans to exit the consumer photography market. Financial analysts were hardly surprised because GAF's photoproducts group had lagged behind Kodak for many years and lost US$3 million in 1976.[1] Historically more significant, however, were a few words buried below the headlines-making announcement stating that the dye business, once the very foundation of the company, would also be dropped. GAF thus became, after Allied Chemical, the

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second of the major US-based dye manufacturers to quit the sector that had launched the synthetic organic chemical industry in World War I. In an ironic turn of events, a large share of the US dye industry was now dominated by German companies whose imports the US producers had struggled to replace during the World War I dye crisis. Among those early producers was the Grasselli Chemical Company, forerunner of GAF.

Grasselli Chemical Company

The origins of the GAF dyes business, with major plants near Linden, Union County, New Jersey, and at Rensselaer, New York State, lay with the Grasselli Chemical Company. Grasselli was founded by Eugene R. Grasselli in 1839 in Cincinnati, Ohio, to produce heavy chemicals such as the mineral acids oil of vitriol (sulphuric acid), nitric acid and muriatic (hydrochloric) acid. The firm later moved to a new plant in Cleveland to be closer to sources of raw material and the main consumers, the oil refiners. When Grasselli died in 1882, his son Caesar A. Grasselli took over the company and within a few years implemented an ambitious growth plan.[2]

In 1889, Grasselli Chemical purchased the Standard Chemical Works, situated near Linden, New Jersey, on the Tremley Point peninsula, close to where the Arthur Kill and Rahway River converge and flow towards Raritan Bay and the Atlantic Ocean.[3] The Standard site included around 300 acres of a marshy area with a mile and a half of waterfront and a barge dock on the Arthur Kill. The main product at Tremley was sulphuric acid, used in large quantities by the local oil refineries. Grasselli diversified in both inorganic and, later, organic chemicals. Acetic acid manufacture was added to the list of Tremley products not long after 1900. Another area of interest involving organic chemicals was that of accelerators used in vulcanization of rubber that enabled restoration of elasticity following deformation. Grasselli Chemical entered this business after 1910 when it acquired a license to the Bayer patent of Fritz Hofmann and Kurt Gottlob, who found that products made from both aromatic and aliphatic amines were good accelerators.

By 1915 the Grasselli Chemical Company had assets of around US$30 million and operated eight manufacturing plants and six warehouses in eastern and mid-western states. Earnings in 1915 were US$4.9 million or 38 per cent on common stock and the earnings forecast for 1916 was 100 per cent on common stock.[4] The company's strong financial position and the changes brought about by the war in Europe, encouraged entry into the manufacture of synthetic, or coal-tar, dyestuffs, following the suggestion of Dr Adolph Wack, chemist at the Verona Chemical Company, which produced coal-tar intermediates in Newark.[5]

Prior to the onset of World War I, Germany and, to a lesser extent, Switzerland, supplied most of the dyes needed by the textile, paper, leather, ink and varnish industries in the USA. The dye shortage caused by the British blockade of German shipping and German restrictions on exports, caused a panic in the market and inflated prices to record levels.[6] In 1914, there were just seven domestic firms making a limited range, mainly from imported intermediates. The total US dye output was only 6.6 million pounds with a value of US$2.4 million.[7] Including imports, the annual consumption in the USA was estimated at US$15 million.[8] Since domestic firms supplied a fraction of the demand, there was from early 1915 an urgent need for increased US production.

Grasselli Chemical built its new dyes plant in the western portion of the Tremley site, an area separated from the heavy chemicals plant to the immediate east by the tracks of the Jersey Central Railroad.[9] To ensure a permanent labour force, Grasselli Chemical constructed 300 one-storey homes to house workers. The community was divided by a wide, tree-lined Main Street into two ethnic sections: Grasselli Park, housing Irish and English families whose men were supervisors, and Tremley, whose residents were mainly Polish and Slovak immigrant workers.[10] The dye plant and the surrounding industrial area was known as Grasselli, which also gave its name to the local railroad station and the main road leading to the plant. However, the Grasselli Chemical site was often referred to as Linden.

Sulphur dyes, mainly the large volume sulphur blacks for the cotton and hosiery trades, were the first dyes produced in 1915. They were relatively easy to make in simple equipment in which mixtures of aromatic compounds such as dinitrophenol and aniline were baked with sulphur. The chemistry of sulphur black was obscure, so its manufacture relied more on craft than science, particularly careful control of temperature and time. The copious evolution of hydrogen sulphide and ammonia ensured that the working conditions were hardly salubrious. Sulphur black was a commodity with 5.6 million pounds imported in 1914. There were only two other producers, both in New York, in 1915: Schoellkopf Aniline & Chemical Works, in Buffalo, and Standard Aniline Products, in Wappingers Falls. The calculated risk soon paid off: In 1914, sulphur black sold for about US$0.20 per pound; during 1915 the price soared to US$2.75–3.00 per pound.[11]

As soon as the USA entered World War I in April 1917 there was a tremendous demand for dyes of khaki shades. The plans for an army of one million men in uniform made necessary 30–40 million yards of cotton khaki shirts and mixed meltons (wool/cotton blends) for tunics and overcoats. The military also needed an olive drab coloured uniform to help soldiers blend in with their surroundings in the European battlegrounds. Prior to 1914, dyes for military uniforms were obtained from Germany. Apart from synthetic indigo, they included vat, or Indanthrene, dyes. The latter were based on derivatives of anthraquinone, the basis of the important red colorant known as alizarin, and developed from 1901 at Badische Anilin- & Soda-Fabrik (BASF) and at Bayer. Vat dyes passed the stringent tests set by the military, including fastness to light and to harsh chemicals such as acids and bleaches. Because they were no longer available in the USA, the military relaxed the fastness tests, requiring only a 30-day light exposure and fastness to soap and alkali.[12] This decision was a boon to makers of sulphur dyes that could also produce khaki shades and no doubt provided the incentive for Grasselli to further enlarge the business. The expansion continued after Caesar Grasselli handed over management to his son Thomas S. Grasselli, in 1916.

While German chemists in America were considered to be high security risks in industry, this was not the case for Swiss chemists. In September 1918, Dr Edwin A. Meier, a Swiss chemist previously at Standard Aniline where he supervised the manufacture of intermediates and sulphur dyes, particularly sulphur black, was hired as plant chemist at Linden. Meier brought with him the valuable dye-making experience that American chemists lacked at the time.[13] The sulphur dye range was expanded to include not only khaki, tan, brown and olive, but also yellow brown, red brown and orange shades.[14] Also in 1918, Linden introduced its first alizarin dye, alizarin blue, for wool, manufactured in two steps from alizarin. The intermediate compounds were made from primary coal-tar intermediates such as nitrobenzene, aniline, phenol and, in the case of alizarin, anthraquinone, available from Verona and other chemical firms that had sprung up in New Jersey, New York and Pennsylvania.

The Bayer Rensselaer Plant Acquired

The strong demand for dyes and the high selling prices during the war encouraged Grasselli to make further investments and acquire relevant knowledge and skills through purchase of an existing business. A prime candidate became available after hostilities had ceased. This was the Bayer plant at Rensselaer, located 140 miles north of New York City, which produced dyes and pharmaceuticals such as Aspirin and phenacetin. It had been established as the Hudson River Aniline & Color Works in 1882, and was successor to the Albany Aniline & Chemical Company, founded in 1868.[15] Bayer initially held a 25 per cent interest in the Hudson River concern that by the turn of the century was managed by the Swiss chemist Emmanuel von Salis, who had worked in England. Dr Carl Duisberg, head chemist at Bayer, visited the site in 1903 and recommended it as a manufacturing location for Bayer's pharmaceutical products.[16] The company became a fully-owned subsidiary of Bayer in the same year.

It was also in 1903 that New York State health officials began to link pollution of the Hudson River with outbreaks of typhoid and other water-borne diseases. The Rensselaer plant discharged directly into the Hudson River 5000 gallons daily of a toxic mixture of aniline oil, hydrochloric acid, sulphuric acid, dinitrobenzene and raw sewage from its 33 employees.[17] The survey provides a glimpse of the environmental problems that would always taint the dye industry's public image and in part contribute towards its demise after 1970.

Pharmaceutical manufacturing buildings were erected at Rensselaer in 1905 in the northern portion of the site. Dye capacity was increased at the same time and more substantially from 1913, when the plant came under the ownership of the Bayer Co. Inc. By 1914 the Rensselaer plant was the third largest producer of dyes in the USA, with a 17 per cent market share. The product line consisted of staple dyes, all invented before the mid-1870s, for the paper and leather industries: induline, nigrosine, fuchsine, alkali blue, soluble blue, and the azo dyes Bismarck brown and chrysoidine. Textile dyes, many of more modern origins, including vat dyes, were imported from Bayer, an arrangement dating back to the 1890s. A novel product made at Rensselaer was Monopole Brilliant Oil, an early synthetic detergent for the textile industry, made by sulphonating castor oil.[18]

The master plan drawn up by Bayer for the Rensselaer site envisioned the largest and most modern chemical plant in the USA, on the lines of the new Bayer

Leverkusen factory in Germany and employing almost 8000 people.[19] The planning, however, was abruptly terminated with the onset of World War I. Dye production, based on imported German intermediates, almost ceased. The Rensselaer plant lay idle for several months in 1915, but resumed production later that year with intermediates produced on site.[20] Several textile dyes that were previously imported were also now made at the plant, particularly the alizarin and azo colours, under the continued management of von Salis.[21] The improved financial position enabled this US operation of the Bayer Company to earn US$1.5 million annually by 1917.[22]

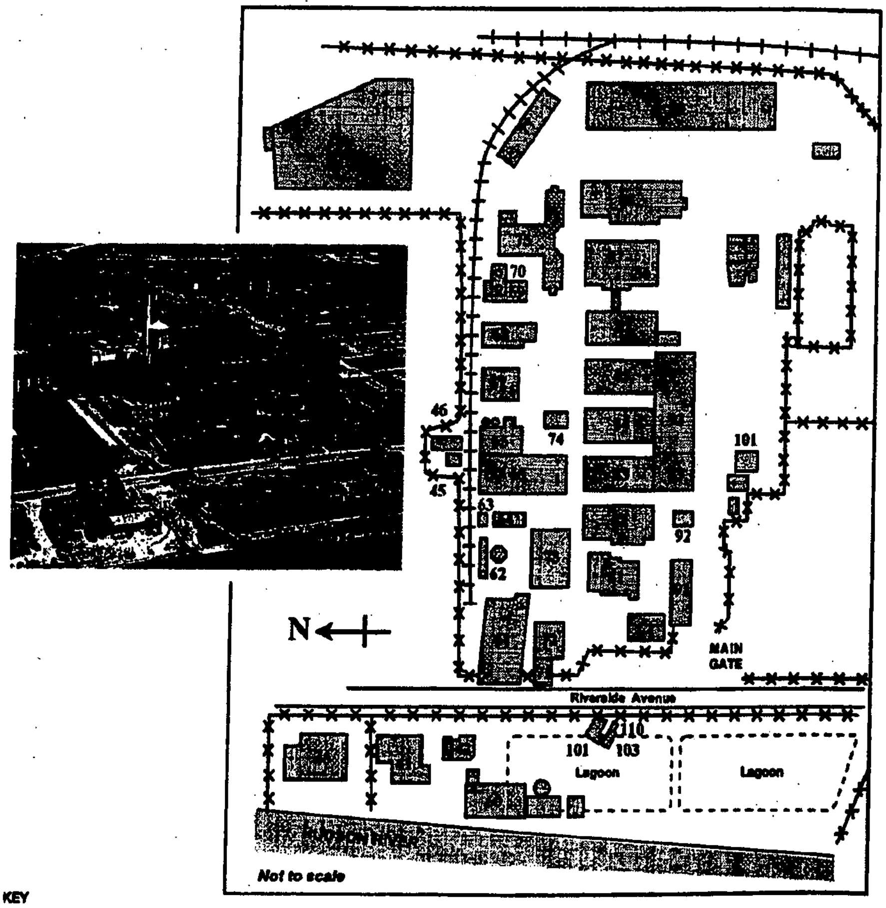
After the USA declared war on Germany, the assets of the Bayer Company were seized, including offices and warehouses, the Rensselaer plant and patent rights. In late 1917 Federal Judge A. Mitchell Palmer, the Alien Property Custodian, announced his intention to 'thoroughly Americanize' the company and named four new members to the board of directors. One of them was von Salis.[23]

In August 1918 five company officials were arrested and charged with diverting profits to a dummy corporation in Rhode Island and thence to Germany. The purpose was to enable Bayer to re-establish its dyes and pharmaceuticals business in the USA when the war ended. Among the men arrested was Dr Rudolph Hutz, at his summer home on Pine Island, Lake Winnipesaukee, New Hampshire. Secret Service agents found a boat and rowed out to the island to make his arrest at 1:30 am.[24] He was charged with violation of the Trading-with-the-Enemy Act and espionage and was interned at Ellis Island. The arrests were followed with the firing of any Rensselaer plant employee suspected of sympathizing with Germany. Rumours that Aspirin was formulated to cause flu outbreaks were spread.[25]

In December 1918 the Alien Property Custodian held an auction of Bayer assets at Rensselaer. The winning bid of US$5.3 million came from the then relatively unknown Sterling Products Company, a pharmaceuticals firm based in Wheeling, West Virginia. Sterling was interested only in the pharmaceuticals business; its bid was made in conjunction with Grasselli Chemical that in 1919 paid Sterling US$2.5 million for the dye section.[26] The Rensselaer site, now occupied by two separate companies, Sterling and Grasselli, was far more compact than Tremley. It covered 75 acres of land and consisted of 20 manufacturing buildings. The location along the Hudson River, southeast of the Port of Albany and adjoining the railroad tracks to the east, expedited the shipping of both raw materials and finished products (Figure 1).

Two-thirds of the Rensselaer production area was dedicated to dyes manufacturing. In order to supply the heavy demand for dyes during the war, several new buildings had been added in the 1915–17 period: an intermediates unit for nitrobenzene, dinitrochlorobenzene, dinitrotoluene and aniline oil, among others; an azo dye unit; a production unit for wool green, the company's first triphenylmethane dye; a boiler room and smoke stack; and an ice making unit.[27] Acetic anhydride was made for pharmaceuticals production.[28] Basic raw material and mineral acid capacity was also put in place, with units producing nitric, sulphuric and hydrochloric acids. This was a strategic advantage because commercial acids were in tight supply as a result of war production requirements, particularly of nitric and sulphuric acids, both required in nitration of aromatics for explosives manufacture.

After the war the market for dyes declined sharply along with the selling prices. The Rensselaer acquisition became a financial burden for Grasselli Chemical. Plans for further expansion of the plant were cancelled and cost-cutting measures were introduced.[29]



KEY

Construction and expansion dates for major Hudson River Aniline Works buildings:
41 1917 Production. 61 1882, 1895, 1905 First production and office building. Rebuilt in 1895 after fire destroyed original building. 64 1917 Ice plant. 65 1906, 1916, 1948 Power plant and utilities. 67 1915 Maintenance and machine shop. 68 1915, 1918 Production. 69 1915, 1966 Storeroom. 71 1895 Office and laboratory. 72 1905 Electrical maintenance shop. 73 1905, 1915 Drying of dye presscakes. 81 1918, 1944 Production. 83 1918, 1933, 1935, 1962 Production of azo dyes. 85 1917 Production. In 1918, Sterling Drug acquired the area to the north, beyond the fence at left.

Construction and expansion dates for Grasselli Dyestuff Corporation, General Aniline Works, General Aniline & Film major buildings:
62 1929 Storage of acid and caustic soda. 76 1932, 1936-38, 1941-42 Analytical research and dye laboratories, production management, accounting, etc. 82 1928, 1936 Production. 84 1926 Production. 86 1927, 1928 Production. 88 1935-36 Milling equipment for finishing of powder dyes. 89 1930, 1936, 1941 Warehouse. 91 1933-34 Main gatehouse, hospital and cafeteria. 93 1946 Main drying facility. Building 87, dating from 1948, was the largest production building constructed under US government ownership. Warehouse 38, erected by Sterling-Winthrop in 1946, was acquired by BASF in the late 1960s to replace 89.

Figure 1 Plan of the Rensselaer Site under Ownership of Hudson River Aniline & Color Works (1882), Grasselli Chemical Company (1919), Grasselli Dyestuff Corporation (1924), General Aniline Works (1928), General Aniline & Film (GAF) (1930), and BASF (1978–2000). Inset is the facility around 1940. Edelstein Collection.

The financial situation was made more difficult because Grasselli Chemical was a novice in dye manufacturing and faced a know-how gap. Thus the production of intermediates at Linden in 1920, some 114,000 pounds, represented just five products, notwithstanding the fact that the company had obtained the rights to 1200 German patents on dyes, intermediates and related chemicals, many through the purchase of Rensselaer. The German patents, however, did not provide sufficient details to enable replication of the inventions claimed.[30] Grasselli Chemical lacked the specialized knowledge to commercialize the dye patents and expand the product line beyond the staples that competitors were also making. It was time to turn to the dye industry of the former enemy nation.

Before the war, Caesar Grasselli had met with Carl Duisberg, now the head of Bayer, on his visits to the USA. This connection now led to a suggestion for a merging of their interests in the dye-making sector in the USA.[31] Though Grasselli was prepared to offer a joint venture proposal, Bayer did not respond immediately in order to avoid giving the impression of officially recognizing the seizure of its US assets.[32]

Around this time Grasselli Chemical established a research department at Linden under a German chemist, Dr F. Reichel. This soon consisted of 10 chemists, but during the recession of 1921–22 the department was abandoned. From that time research was carried out within individual manufacturing departments, aided by a general analytical laboratory opened in 1921. There was a significant input from a Grasselli-owned laboratory in Geneva, Switzerland. There, Hans Heer, educated at the Swiss Federal Polytechnic, in Zurich, from October 1920 undertook research on alizarin dyes. At that time one alizarin colorant, alizarin blue, was made at Linden, by nitration of alizarin, to afford alizarin orange A, that with glycerol and iron in the presence of sulphuric acid gave the blue. Investigations, probably mainly with alizarin blue, led to the discovery of other alizarin dyes. During three years, Heer developed new processes and in 1923 was moved from Geneva to Linden, where he was appointed laboratory chemist in the Alizarine Department.

The recession considerably worsened the financial position of Grasselli Chemical. The average selling price of US-made dyes dropped from US$1.26 per pound in 1917 to US$0.83 in 1921, a 34 per cent reduction.[33] In early 1922, Grasselli, along with other US dye-makers, supported the enactment of a protective tariff against foreign competition. William T. Cashman, vice president, testified at a Congressional hearing that the company had invested US$4.5 million in the dyes business but was losing money. He cited the fierce competition among US producers of wool green and nigrosine dyes to counter any allegations of a dye monopoly.[34]

The Fordney–McCumber Tariff Act of 1922 helped the domestic dye industry by introducing high tariffs and anti-dumping fines on coal-tar chemicals and dyes that competed with products made in America. The *ad valorem* rate on dyes and finished coal-tar products was 60 per cent; on intermediates the rate was 55 per cent. These rates applied for the first two years after the passage of the act and then decreased to 45 per cent and 40 per cent, respectively. The specific duty was US$0.07 per pound. The *ad valorem* rate was based on the US selling price of competing products.[35]

The I. G. Farben Influence

Now that the tariff barrier was in place Grasselli Chemical was in a far stronger position to seek marketing and technical assistance from Bayer through a joint venture. Bayer was receptive because it was eager to re-establish dyes manufacturing capacity in the USA mainly to overcome the burden imposed by the tariffs. Grasselli came to a collaborative agreement with Bayer in June 1924 to form the Grasselli Dyestuff Corporation, as operator of the Linden and Rensselaer dye plants and sole distributor of Bayer dyes in the USA.[36] Grasselli Dyestuff, in which each company had a 50 per cent share, was incorporated in Delaware with a capital of US$4 million.[37] The main office was in New York City and the officers were G. E. Fisher, president; Edward W. Furst, vice president; Dr Roger N. Wallach, vice president and treasurer; and Rudolph Hutz, vice president and secretary. Fisher and Furst were vice presidents of Grasselli Chemical. Wallach and Hutz came from the dyes department of Grasselli Chemical. Wallach was previously technical director of Standard Aniline, which had shut down in 1919. Hutz, the former Bayer official arrested during World War I, had been released after the Armistice was signed and then joined Grasselli Chemical.

Grasselli Chemical and Bayer assigned all present and future patents to Grasselli Dyestuff and it was agreed that the new corporation would forego exporting its own manufactured dyes except to Canada. The Grasselli Dyestuff Corporation had its own sales and technical organizations, though these functions were soon taken over by the General Dyestuff Corporation (hereafter GDC), formed in July 1925. This new sales organization was headed by veterans of the imported dye business: Adolph Kuttroff, chairman of the board; Herman A. Metz, president; and Ernest K. Halbach, the dynamic secretary and general manager who later controlled GDC and acquired a major interest in the Verona Chemical Company. GDC had the US selling rights for the largest German dye producers, Bayer, BASF and Hoechst, that merged to form the behemoth I. G. Farben in 1925 (later absorbing Agfa, Griesheim-Elektron and Weiler-ter-Meer). The Grasselli Dyestuff Corporation continued only as a manufacturer.[38]

Grasselli Dyestuff and GDC fitted in well with the I. G. Farben strategic plan for global expansion launched through business combinations, often involving exchanges of strategic knowledge, and takeovers. The close involvement of I. G. Farben resulted in an infusion of capital and the transfer of German technical personnel to modernize and expand the two facilities. This strategy was endorsed by Fritz Ter Meer, member of the board of directors of I. G. Farben in charge of dyestuff production, who visited the USA in 1926. To direct the reorganization at Rensselaer, Dr W. Walther was sent over from Leverkusen. Walther was succeeded by Dr C. C. Burgdorf, also from Leverkusen, who concentrated his efforts on improvements at the Linden plant. Rensselaer still needed technical assistance, so Burgdorf asked Leverkusen for help. In 1926, Dr Harry W. Grimmel was sent over, replacing von Salis as general manager. By 1927 the Rensselaer staff had increased to 311 employees: seven chemists, two engineers, a colorist, 15 foremen and 286 workers.[39]

Naphthalene Intermediates

A formal Intermediates Department was created at Linden in 1925 to coordinate growth of the product line. In the same year construction began on the first of a series of substantial new buildings, No. 46, for the production of intermediates. The most important of these, including H-acid, were derived from beta-naphthol, and shipped to Rensselaer for the production of direct dyes, water-soluble azo colorants with good affinity for cotton and rayon. The manufacture of H-acid, a complicated multi-step process, had been attempted at Rensselaer in 1918 but was then unsuccessful.[40]

Dr Nathan Fuchs, who joined Rensselaer in 1925, undertook intermediates research at Linden from 1927, in which year J. Albert Prochazka was engaged in the production of intermediates in building No. 46. Heavy demand meant 24-hour operation in the intermediates buildings, based on two shifts, one during the day of 10 hours, the other at night of 14 hours.

Azoics

In the 1920s the textile industry began to expand the use of the new azoic dyes, azo dyes that are produced within the cellulose fibre. This was done by padding the fabric with the coupling component of the dye, followed by treatment with the diazo component. The insoluble dye thus formed was very fast to washing. The azoic dye process gave the textile industry a complete range of bright shades with excellent fastness properties.

The development of the US market for azoics demonstrates how I. G. Farben dyes were commercialized in the USA through initial importation of dyes and certain intermediates, thus preventing disclosure of valuable proprietary information about both products and processes. Griesheim-Elektron, one of the smaller members of I. G. Farben, had discovered that Naphtol AS gave fast shades when coupled with various diazo components on cotton.[41] GDC began importing the azoic dye components from Germany in 1925. Griesheim supplied the coupling components, Naphtol AS and seven congeners. Bayer Leverkusen supplied 16 different diazo components, or bases, such as Fast Red G. Once the azoics market was well established with the imports, the Grasselli Dyestuff plants began domestic manufacture of the components. The Naphtol AS components were made at Linden.

'Fast Color Salts' and New Dyes

A significant technical advance soon followed, the so-called 'fast color salts', diazos prepared in stable powder form. As a result, the dyer no longer had to diazotize the base with nitrous acid in ice, a difficult and time consuming procedure in a textile mill. The fast colour salts were simply dissolved in water and applied to the naphtholated fabric under slightly acid conditions. The dry diazo salts were stable for years and their solutions could be kept much longer in a mill than a normally diazotized base.[42] In 1927 the Rensselaer plant became the first in the USA to produce fast colour salts and later produced the rapid fast colours as pastes that further simplified the dyeing procedure.

New dyes in the Rensselaer product line included triphenylmethanes, azines, acridines, euchrysines and phosphines.[43] Many were basic dyes used to dye wool, silk and paper bright shades from an acid bath. Linden further expanded with a US$200,000 engineering building, No. 47, completed in 1928.[44] The first head of engineering was John Newman, replaced in 1923 by Charles B. C. Fellows and then in the 1930s by Franz Brandt and H. P. Angermueller, sent over from BASF at Ludwigshafen, along with another engineer named Kropp. Buildings at Linden, arranged in ordered rows, were erected on deep piles, and were open below the ground floor in order to minimize damage from frequent floodings that inundated the plant. Together, the Linden and Rensselaer plants now offered an impressive list of 250 dyes.[45]

In 1928, the Grasselli Chemical Company was purchased for US$64.8 million in stock by Du Pont,[47] that took over the heavy chemicals section of the Linden plant and sold Grasselli Dyestuff, that occupied the so-called West Works, and owned Rensselaer, to I. G. Farben. The name of the dyes business was then changed to the General Aniline Works, Inc. Dr Ferdinand Max was sent from Ludwigshafen to Linden where he was appointed general manager and assistant vice president of the General Aniline Works.[46] His transfer continued I. G. Farben's strategy of placing its best technical employees in leadership positions in the USA in order to facilitate technology transfer, protect strategic knowledge and strengthen its position as a domestic manufacturer.

Anthraquinone Vat Dyes

Though the General Aniline Works had a diverse product line, vat dyes, one of the fastest growing classes, were excluded, in part because they were imported from Germany. Vat dyes, which include indigo and anthraquinone-based dyes, are insoluble in water. They must first be reduced to the leuco form in an alkaline solution of sodium hydrosulfite before application to the cotton or rayon fibre. Air oxidation fixes the dye on the fibre, resulting in excellent wash fastness and light fastness. Although the vat dyes were costly to manufacture because of their chemical complexity, they were in great demand in the USA for heavily laundered items like denims, shirts and bed linens and outdoor fabrics such as awnings.

Indanthrene blue was the first anthraquinone vat dye, synthesized by René Bohn at BASF in 1901. He used the synthetic indigo reaction conditions with 2-aminoanthraquinone, fusing it with caustic potash, to obtain the colorant. By 1906, Bayer had introduced the first vat red and marketed a range of colours under the Algol brand.[48] The USA imported vats from Germany and, and from 1907, Switzerland. Domestic production was hindered by German patent protection, the lack of sufficient anthracene (source of anthraquinone), inadequate technical expertise and the large investment needed for organic solvent operations and specialized equipment.

A breakthrough occurred in 1917 when government chemists in Washington DC developed a process to manufacture anthraquinone from readily available coal-tar naphthalene and benzene. Sulphonation of anthraquinone gave anthraquinone-2-sulphonic acid, named silver salt because of the silvery sheen of its crystals. Reaction of silver salt with ammonia in an autoclave at 200°C and pressures of up to 1000 lb/in^2 yielded 2-aminoanthraquinone, a source of several vat dyes. The use of toluene instead of benzene gave 2-methylanthraquinone, the starting material for vat orange dyes. Far more significant, however, was the versatile 1-aminoanthraquinone. This required mercury-catalysed sulphonation of anthraquinone, to afford what was known as diamond salt, followed by arsenic-catalyzed amination. Diamond salt was a source of olive greens, browns, greys, etc. This often involved many steps, apart from separating, drying and finishing.

In 1919, Du Pont accomplished the first successful commercial production of anthraquinone vat dyes in the USA. One year later, a range of colours was available, marketed under the name Ponsol for Du Pont and Anthrene for the Newport Chemical Company. In 1927 National Aniline & Chemical Company, a subsidiary of Allied Chemical & Dye Corporation, entered the market with its Carbanthrene range.[49] In 1928 the production of vat dyes, excluding indigo, grew to 6.3 million pounds, representing almost 7 per cent of total dye production in the USA.

Competitive pressure compelled the General Aniline Works to supplement its imported products by entering the vat dyes market. In 1927, 157,000 pounds of Indanthrene Brown R was made at Linden in powder and paste forms.[50] In 1928 the Alizarine Department was merged into the new Vat Colors Department. The product line was expanded in 1929 with Indanthrene Olive RA, Indanthrene Dark Blue BOD Paste, and Indanthrene Brilliant Orange RKA, all replacing the imported types.[51] The I. G. Farben designation Indanthrene would be used until the end of vat dye production at Linden in the 1970s.

Another important development was the conversion of sulphur black into a blue colorant. This was a further example of the growing capabilities of American manufacturers. In 1925 an attempt was made to introduce an I. G. Farben process at Linden, but it was a total failure. Three years later the Linden Sulfur Color Department achieved the successful conversion and a special Sulfur Blue Department was created to take advantage of the important new commercial product.

During 1927, I. G. Farben sent a team of technical specialists to the USA to expand and reorganize the US facilities. In June 1928 I. G. Farben consolidated the General Aniline Works, Agfa-Ansco, Winthrop Chemical Company and its shareholdings in two other foreign subsidiaries, Norsk Hydro of Oslo and dyemaker Durand & Huguenin of Basel, into the Swiss holding company I. G. Chemie (Internationale Gesellschaft für Chemische Unternehmungen A.G.). The following year the American firms merged to become the American I. G. Chemical Corporation of New York. Financial control was exercised through I. G. Chemie. I. G. Farben guaranteed the dividends of I. G. Chemie in return for the option to purchase I. G. Chemie's foreign investments at book value.[52] These manoeuvres enabled I. G. Farben to further strengthen its position in the USA, its leading market, and to raise funds in the capital market to pay for the restructuring costs.[53]

By the close of 1932, I. G. Farben had invested US$12 million in modernizing and expanding its US dye operations. Though the profits in 1930 were insufficient to cover variable costs as a result of the new investments, I. G. Farben became one of the big four dye producers in the USA. Together, I.G. Farben, Du Pont, National Aniline & Chemical and Calco Chemical (an American Cyanamid subsidiary) held a 90 per cent share of the US market. During the following years there were further transfers of technical experts from Germany, including Dr Francis P. Bluemmel, who, with almost a decade of prior experience at Ludwigshafen, joined Linden to take charge of intermediates in 1935. Later he was appointed supervisor of process development for vat colours.

The introduction of synthetic fibres stimulated the invention of new dyes. Celliton acetate colorants, mainly based on derivatives of 1- and 1,4-aminoanthraquinone, were introduced by I. G. Farben in 1934. Shortly after, Linden made some members of this class. Also in 1934, there appeared a completely new chemical class of colorant, the phthalocyanines, introduced by Imperial Chemical Industries (ICI) in Britain. Much to the surprise of ICI, the manufacturing process was quickly improved by I. G. Farben which introduced its products as Heliogens. They were manufactured at Linden from 1936.[54] Another source of know-how at General Aniline was based on licensing of Algosol (soluble vat) dye and intermediate processes from Durand & Huguenin.

Diversification: Amino Resins and Surface Active Agents at Linden

During the 1930s the American chemical industry embarked on extensive diversification, stimulated by new needs, such as the requirements of the electrical and automobile industries, and discoveries made possible through advanced research facilities that arose from dye research. Du Pont became synonymous with polymers, particularly nylon, and American Cyanamid with amino resins, notably melamine, and sulfa drugs.[55] Diversification at General Aniline was also extensive, though closely tied to innovations made at I. G. Farben, at first amino resins and surfactants.

Commencing in 1931, the Linden plant manufactured amino resins based on I. G. Farben patents and arrangements with European and US manufacturers, including American Cyanamid. Manufacture of I. G. Farben Unyte urea-formaldehyde resin was carried on through a subsidiary, Unyte Corporation. The Unyte unit was managed by Max W. Levy, who had worked on sulphur dyes at Linden in 1919, and then moved on to the first manufacture of intermediates, also in 1919. In 1936, Unyte combined with Toledo Synthetic Products to form the Plaskon Company. The products later included phenol (bakelite type) and melamine resins. In 1948, Plaskon, which operated in the then building No. 35, was acquired by the Libby Owens Ford Glass Co., of Toledo, Ohio, and soon after resin manufacture at Linden ceased.[56]

Detergents represented far greater potential for growth, in part because of the intense competition among amino resin producers. I. G. Farben was an early manufacturer of synthetic detergents (surface active agents, known today as surfactants). These synthetic products were soon appreciated for their far superior emulsifying, wetting and dispersing properties when compared to soap and found many industrial and consumer applications. In 1930 the Igepon A products, fatty acid esters of hydroxyethanesulphonic acid, were first marketed in Germany. The A stood for äthan, or ethane. The Igepon T products, introduced the following year, were amides formed by reaction of fatty acids (such as oleic acid) with taurin compounds (aminoethanesulphonic acids). The

General Aniline Works quickly saw the market potential for these products in the USA, obtained the basic technology from I. G. Farben and developed manufacturing processes and applications at the Linden plant. Igepon A was produced in 1931; Igepon T followed in 1932, as a powder made in a German-built spray dryer. In 1933 Linden produced Igepon T gel in response to the textile industry's preference for a non-dusting, easy-to-handle liquid.[57] This product, eventually the largest selling Igepon, was not made in Germany. The surfactants business was very profitable due to patent protection and represented the most significant area of diversification for Linden. In surfactants, at least, the generic model adopted for the introduction of novel dyes in the USA, based on initial protection of knowledge, sometimes through imports and sometimes through trusted employees, was not strictly followed.

Linden under I. G. Farben

By 1937 the Linden plant was one of the larger manufacturing sites for organic chemicals in the USA. As many as 300 dyes were produced in addition to 400 intermediates, some of which were supplied to the Rensselaer plant for conversion to dyes, and the two important surfactants. The dye range consisted of both commodity and specialty colours. All manufacturing was carried out in batch operations. The largest volume commodity products were run in dedicated equipment. Smaller volume products that were run less frequently were made in flexible equipment. The multi-purpose reactors, generally located on the second floors of buildings, could withstand acid and basic conditions, and high and low temperatures and pressures. The 145-acre site had a power house; machine shop; lead burning shop; cooperage; laboratories (research, control, analytical); pilot plant; and manufacturing buildings (Figures 2 and 3).

The Linden plant was divided into three rows, or blocks, of buildings designated A, B and C, each running north to south, with the A block at the east, closest to the Arthur Kill. The A block, that included the original structures dating from the World War I period, included buildings for the production of the black and dark blue sulphur colors, the warehouse, power house, and the first administration offices (later moved to building No. 100 in the B block). All machinery was electrically driven by 220 volt current supplied by a steam-driven generator. Compressed air was supplied by central compressors in the power house. Steam was produced at both 90 psi and 450 psi and distributed throughout the site.[58] The B and C blocks contained modern buildings, made of steel and brick or concrete, and fitted with large windows for light and good ventilation.

Intermediates for azo dyes were produced in two buildings, Nos. 46 and 49, in the B block, each bridged to a four-storey building, No. 48, built in 1934, that on the lower floors served as a warehouse, and above them housed the control laboratory. The older building, No. 46, dating from late 1928, was used for intermediates that required a long manufacturing cycle or campaign (2–10 days) for processing. In one section there was a long row of kettles for acid reactions, such as sulphonations and nitrations, at temperatures of up to 150°C. The products, transferred by compressed air to diluting kettles or tanks, were precipitated by adding salt or by neutralizing excess acid with lime.

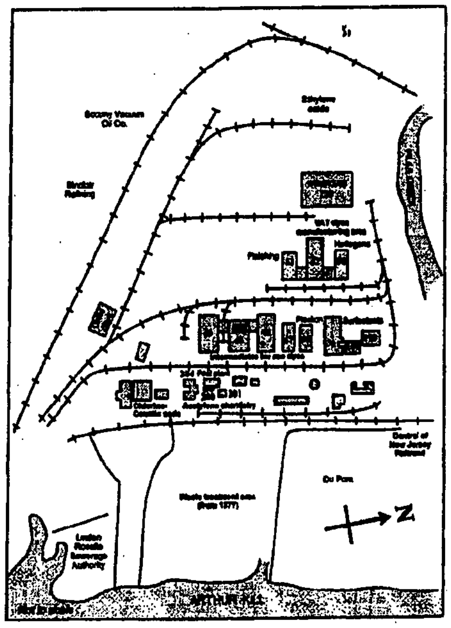


Figure 2 Plan of Linden Factory, General Aniline & Film.

Products were then separated by filter presses or brick-lined vacuum filters. In most cases the processing was completed at this stage and the finished product discharged into barrels. The flexibility of equipment allowed the processing of eight to 14 different products simultaneously. One hundred different products were made in building No. 46 in 1937. The newer intermediates building, No. 49, erected in 1937, was designed for products requiring shorter cycles and processes that required organic solvents, such as vat dye processes. It included a distillation unit for recovery of solvents.

The laboratory in building 48 also provided space for research facilities. It was there that on 26 August 1936, Dr Paul Nawiasky, a vat colour expert from Ludwigshafen,

Figure 3 Linden, looking North, July 1947. At right is block A, with, closest, building no. 204, the newly constructed pilot plant, mainly for acetylene chemistry. At centre is block B, and at left is block C, with building No. 53 closest. Photograph courtesy of Newark Public Library.

inaugurated a formal research department. His staff consisted of two, a Dr Menard, who left after a short while, and Gus Luttringhaus, the first laboratory assistant. The laboratory contained eight benches and was known as the Grasselli General Laboratory. Later members of the department included Dr Albert Vajda (joined November 1937), Dr Werner Freudenberg (October 1939), later with the Intermediates Department, Dr Jesse L. Werner (December 1938), and Dr John Taras (October 1939), subsequently associated with Vat Colors. In 1938, the management named the laboratory the Research Laboratory. Its principal function was dye research. In the same year, building 48 was enlarged.[59]

The main structures in the C block, dedicated mainly to alizarin and vat processes, were two large buildings, Nos. 50 and 52, connected by a bridge known as building No. 51, that housed the control laboratory for processes conducted in this block. On the ground floor of the north building, No. 50, trucks delivered raw materials and received containers of finished dyes. As in the B block, the second floor housed kettles in which intermediates, some made in the B block, were converted into dyes. The dyes, usually in liquid suspension, were separated by filter presses on the third floor. The dye filter cakes were then transported across the bridge to building 52 where they were dried or mixed as pastes. The drying was done on the third or top floor, the grinding on the second and the milling on the ground floor. Building 53, to the south, was erected in 1938, and from then on served as the finishing and warehousing unit. Imported Cellitons, for example, were dispersed and standardized there.

Rensselaer and a Merging of Interests

The Rensselaer site was just under half the size of Linden and the arrangement of buildings more compact. There the ordering in blocks similar to Leverkusen was also adopted during the period of expansion carried out from the mid-1920s. Building No. 75, completed in 1932, and expanded in 1936 and 1942, housed the analytical, research and dye laboratories and offices for the works production management and accounting. The various structures represented 'examples of purely functional industrial buildings mixed with an amalgam of Bauhausian, International Style, and Art Deco-inspired architecture'.[60]

General Aniline now dominated the vat and azo dye markets as a result of the many patents assigned to it by I. G. Farben and the expansion of its facilities. For a while, the company was the leading producer of dyes in the USA, at least until Du Pont caught up in the late 1930s. Despite the Depression, dye manufacture in the USA during 1936 was at record levels, 54,100 metric tons, which was 4500 tons greater than in 1929, the previous record year. In 1938 there were 1220 employees at General Aniline.

The war in Europe initiated major changes in the ownership, management and direction of General Aniline. In late 1939 I. G. Farben prudently dropped the I. G. initials in the name of its American holdings, forming the General Aniline & Film Corporation. This move merged the General Aniline Works with Agfa-Ansco, which marketed Agfacolor film in 1936—one year after Kodak introduced Kodachrome—and Ozalid, maker of blueprint copying machines. However, war in Europe meant, once again, shortages of supplies from Germany, including of photographic chemicals for Ansco. In the case of colour formers, derivatives of aromatic amines, not even the formulae were known.

US Government Ownership

Concerns over possible Nazi influences on US industry led investigators from the Securities and Exchange Commission to raise questions about the ownership of General Aniline. After they received evasive answers from three members of the board,[61] government officials concluded that I. G. Chemie was no more than a dummy corporation for I. G. Farben. The decision was made to remove German board members.[62]

The I. G. Farben influence that began in the collaborative arrangement between Bayer and Grasselli in 1924 came to an abrupt end following US entry into World War II in December 1941. The Treasury Department immediately installed 17 secret service agents in the main offices and plants of the corporation to ensure US control of all activities and prevent disclosure of sensitive information to Germany.[63]

Then in January 1942, the Treasury Department ousted five German-born executives, all naturalized American citizens, for personifying the Nazi domination of the company. These officials were the senior operating executives of the corporation. One was Rudolph Hutz, vice president in charge of general production and a director, who had been interned in World War I.[64] Fifty other executives and key workers, regarded as undependable, were also fired. They included engineers Angermueller and Kropp.

On 16 February 1942, the Secretary of Treasury issued an order for transfer of stock to the government, that is, formal seizure of the assets of General Aniline & Film as enemy property. Four American businessmen were put in charge as appointees of the Treasury, charged with redirecting activities to the war effort: Robert E. McConnell, with a background in mining and banking, as president; and, as vice presidents, George Moffett, chairman of Corn Products Refining Co.; Robert E. Wilson, president of Pan American Petroleum & Transportation Company; and Albert E. Marshall, president of Rumford Chemical Works. The first director of the dyestuff division was Colonel Joseph H. Bates, of the Bates Chemical Co., Inc., of Lansdowne, Pennsylvania, who served from March 1942 until the end of 1943. Reorganization in July 1943, after Leo T. Crowley replaced James E. Markham as Alien Property Custodian, led to the appointment of George W. Burpee as president. Evan C. Williams, formerly at the Shell research laboratory in California, was vice president and director of research.

Following Americanization, General Aniline & Film Corporation supplied 50 per cent of the federal requirements for vat dyes used in military uniforms and was the largest producer of this dye class in the USA. Head of vat dyes at Linden after the government took over was Russell Baker, a 1916 graduate of Lehigh University who joined Grasselli Chemical in 1920 to take charge of the alizarin section. At the end of the 1940s he became general manager of the plant. Ernest K. Halbach, then president of GDC, served on the Industry Advisory Committee of the War Production Board that helped the government secure chemicals, including dyes, for war production. General Aniline had a distinguished war record, with both Linden and Rensselaer receiving the Army-Navy E production award for outstanding production of dyes for uniforms, camouflage cloth and smoke bombs; synthetic detergents; waterproofing compounds for tents; mildew preventatives; and chemical intermediates. Almost 15 million pounds of dyes were produced in 1943 for military purposes alone, some 6 million pounds more than in the previous year. Corporate sales rose from US$40 million in 1941 to almost US$60 million in 1943 as a result of the record production of dyes, synthetic detergents and photographic products, aided no doubt by the influence of Halbach in procuring orders via GDC.[65]

An important strategic asset, including in the military sense, that came into the hands of the Americans arose from a 1940 agreement over patents between General Aniline & Film and I. G. Farben, whereby General Aniline became owner of certain key German innovations. The agreement covered research, inventions and technical knowledge and experience. Included were details of novel high-pressure reactions of acetylene, some of which had been investigated at Linden from 1937, including vinylation, the reaction between acetylene and alcohols to form vinyl ethers. A new pilot plant, building No. 201, had been erected for this type of work in 1940. Soon after, in 1941, building No. 201 came under the control of Dr Hans Beller, a former Ludwigshafen chemical engineer, whose main challenge was development of a completely different product, namely carbonyl iron, based on both patents and know-how previously acquired from I. G. Farben.[66] His endeavours enabled the Linden plant to produce carbonyl iron powder, used to manufacture radio frequency electrical cores needed by the military. In the first step, iron pentacarbonyl was produced by a high-pressure reaction between iron and carbon monoxide. This intermediate was then decomposed by heat to form chemically pure iron. The resultant powder consisted of very fine spherical particles with superior electromagnetic properties. It was so critical to the military that a standby plant was built at the Huntsville Arsenal, Alabama, following failure of the competing Ferroline Corporation process at Shreveport, Louisiana. General Aniline was retained to design the plant and start it up in July 1943. After 125,000 pounds of strategic inventory was produced, the Huntsville plant was mothballed until 1949 when it was restarted and leased to General Aniline.[67] Linden production was then transferred to Huntsville.

More Wartime Research and Development

Prior to 1942, General Aniline & Film depended on I. G. Farben for research to support all of its business areas. Though General Aniline had not duplicated I. G. Farben research in the USA, details of a few innovations made at Linden were sent to Germany. These related mainly to dyestuffs. A small amount of research was carried on in the photographic film plants. Certainly, no fundamental research or expansion into new fields was done. 'The result of this policy was the complete subservience of the Company [General Aniline] to its German associate, for the results of the German research were never disclosed to the Company.' Moreover,

> in many cases important material was only communicated verbally to the most trusted employees of the Company on the occasion of their visits to Germany .... The information thus obtained was not disclosed to other employees of the Company. Thus on several

occasions when the man in possession of information died [General Aniline] was obliged to send another employee to Germany for instruction in the particular process.[68]

The outcome was that after the government takeover General Aniline had 3900 patents in its vault but lacked the technical staff to commercialize the inventions. The US management team committed US$10 million to create a first-class research organization, the Central Research Laboratory, established in the Lehigh Valley, at Easton, Pennsylvania, in the summer 1942. The location was chosen because a five-storey building, with 70,000 square feet available, leased from the Stewart Silk Corporation, could be immediately occupied. This was an important consideration at a time when there was a shortage of construction materials. By the autumn of 1942, some 50 chemists, engineers, physicists and technicians had been brought together by Dr William D. Hanford, the research manager. The researchers came from both within the corporation and leading scientific institutions in the USA.[69] The staff was soon increased to 400 employees, making the laboratory one of the largest industrial research centres in the USA. The early effort was focused on dye chemistry but was soon extended into broader fields, including high-pressure acetylene chemistry.

The Easton laboratory was some distance from the General Aniline dye plants: 65 miles from Linden and 195 miles from Rensselaer. Under normal circumstances, at least around 1940, a company's research facility would be located closer to a production site to allow field visits, conduct pilot tests and promote the exchange of information. However, war with Germany was underway and the government was anxious to move quickly to protect and develop the technology of the seized company. The latter may also have been factored into the decision to site the research laboratory in a rather remote location. Treasury Department agents closely monitored the activities and communications of the research staff. German chemists, including even senior managers believed to have close ties with their homeland, though not high security risks, were reassigned to the Easton laboratory. One such chemist was Harry Grimmel, who had worked for Bayer at Leverkusen and came to Rensselaer in 1926 as general manager. He was appointed research section head in azo dyes at Easton. One of his first assignments was the preparation of a historical summary of the dye industry for his new masters. After his forced transfer to Easton was over, Grimmel left the company in 1947 and founded Metro Dyestuffs in Coventry, Rhode Island, later incorporated into Hoechst Chemical Corporation.[70] Ferdinand Max, senior manager of General Aniline Works, was similarly reassigned to Easton in 1942 as director of vat dyes research. Max left the company in 1948 to join competitor Ciba States Limited that was planning to manufacture vat dyes at Toms River, in Ocean County, New Jersey. Another German chemist assigned to Easton was F. Reichel whose fiancée lived in Germany. When Allied bombing of German cities began, Reichel complained to his neighbours, who called in the FBI. Reichel was handcuffed in the Easton laboratory, carted off to Ellis Island and later to a special prison.

Angermueller was replaced by David E. Pierce, who in 1945 was appointed chief engineer for Linden, Rensselaer and Easton. The pre-war works manager Paul Strubin remained at Linden, probably because he was of Swiss origin. The only former German chemists allowed to remain at Linden were the few who were Jewish, were married to

Jewish women, or who had expressed strong anti-Nazi sentiments. They included Beller, who was moved to Linden in 1941. Some had been assigned to posts outside of Germany, including at Agfa-Ansco, by sympathetic managers at certain divisions.[71]

In 1942, the Linden research laboratory became known as the Grasselli Research Laboratory, to distinguish it from the Easton facility. From August 1942, the Grasselli laboratory included an Ansco division that undertook research into photographic materials. The constitutions of the important colour formers were quickly worked out with the aid of chemists at Easton. The outcome was production from 1942 of colour formers in what was known as Department 600, erected on the roof of building No. 48. In 1943, after 15 chemists were transferred to Easton and four to manufacturing departments, the Grasselli Research Laboratory became the Process Development Department of what was now the General Aniline Works Division.

By 1945, the Easton Central Research Laboratory employed 107 research workers, of whom 67 had PhDs, or higher degrees, including in physics. Research and process development was carried out elsewhere by specialists that included 68 men with degrees in engineering and science. Research expenses had climbed from US$382,000 in 1941 (of which US$13,000 was spent on basic research) to US$2,445,000 in 1944 (US$1,582,000 on basic research). By the late 1940s, annual research expenditure exceeded US$5 million. The General Aniline Works Division manufactured dyestuffs and auxiliaries used in the dyeing processes, miscellaneous chemical products, including detergents, carbonyl iron powder, and resins; the Ansco Division manufactured photographic films, papers and chemicals, as well as cameras; and the Ozalid Division produced sensitized materials and machines for printing and developing.

Easton pioneered automated methods for standardizing dyes with respect to shade, strength and brightness. Dr Isaac H. Godlove was senior physicist at the Easton laboratory, which he joined in 1943 after working for the Munsell Color Company and Du Pont. The colour research of Godlove and his colleagues Harry Hemmindinger and Hugh R. Davidson led to the development of the General Aniline Librascope in 1949. The Librascope represented breakthrough technology that enabled colour measurement and analysis in only a few minutes with a high degree of precision. The instrument would find practical applications in dye plants and textile mills where it resulted in objectivity in colour testing.[72] Godlove published many technical articles and was recognized as a leader in the field of colour and its application to human psychology.

The Early Post War Period

During 1944 and 1945 production of dyestuffs at General Aniline was at record levels, and in the latter year was twice that achieved in 1941. The Linden plant was producing 800 different dyes and 700 intermediates. Edwin Meier, the Swiss chemist who joined Grasselli in 1918, was head of the Sulfur Colors Department that also made surface-active chemicals. There were around 65 sulphur colours and an equal number of surface active and auxiliary chemicals employed in the textile industry. Novel surface-active products and allied detergents were bringing in greater profits than sulphur colours. New products included Nekal NS, a wetting agent for textile treatment, and Glim, a liquid for quick, easy dishwashing, developed during the war and introduced in 1946. Products manufactured for Ansco in Department 600, included 6 colour formers, and 14 sensitizing dyes.

The two dye-making plants employed almost 4000 people and produced at the rate of 75 million pounds of dyes and intermediates per year. Rensselaer was turning out 1200 different dyes and 1000 dye intermediates.[73] In 1945, Burpee announced that there was ample dye production capacity to meet the needs of the textile industry. However, by the beginning of 1946, when monthly production of chemicals at Grasselli was 5 million pounds, there was a large unfilled export demand for dyes.

The monthly research letters provide a useful glimpse of activities at Easton. Most work focused on exploiting the patent position held as a result of the 1940 agreement. 'These patents deal, to a very large extent, with the chemistry of acetylene and for new methods of handling acetylene under pressure and at high temperatures. Under these patents,' it was recorded in December 1945, 'two products have been developed through the pilot plant stage: (1) Polectron ... and (2) Koresin .... Both of these products require the same general technique for handling acetylene under pressure.'[74] Research had been hampered under the wartime conditions, but had subsequently been placed on a systematic footing, particularly the polymerization involving methyl vinyl ether and other ethers. Studies into the role of peroxides as initiators in vinyl polymerization were also conducted and, as a result, the first polymerizations of vinyl pyrrolidone, obtained in five steps from acetylene, were carried out at Easton using hydrogen peroxide at 100°C. Information from Europe 'on new method for synthesis of acrylic acid esters ... fits nicely with our work on the development of acetylene chemistry.' There was an interest in novel vat dyes and dyes for nylon. More physicists had joined the staff at Easton, 'which enables fundamental research on properties of dyes, detergents, polymers.'[75] On 1 October 1946, Hanford was replaced by Dr Arthur L. Fox, who had joined Easton in 1942 from Du Pont to take on applications research. Assistant director of research was Warren F. Busse, previously section leader in physics at Easton.

The Grasselli laboratory, or Process Development Department, at Linden had a staff of 130, including 26 chemists and engineers and consisted of five sections: Vat Colors; Intermediates; Ansco; Process Engineering; and Analytical. One of the most ambitious and capable chemists in the department was Jesse L. Werner, who joined General Aniline as a research chemist after receiving his PhD from Columbia in 1938. He was group leader in the Vat Colors Section during 1942–6 and then section leader of the Intermediates Section. He also served as technical librarian and would later head General Aniline. In May 1946, Hans Heer, who had undertaken research into alizarin dyes during the 1920s was appointed head of the Vat Color Department.[76] Nawiasky and colleagues developed wetting agents and Heliogen blue in the Process Development Department.

To meet the tremendous growth in manufacturing operations an increased water supply was essential at Linden, particularly for cooling purposes. Until 1945, the source was the adjacent Du Pont works. General Aniline decided to draw directly from the waters of the Arthur Kill, that had one-third the salinity of sea water. A new pumping station was erected on bedrock below the Arthur Kill during 1945–46. The intake was located at a depth of 24 feet below average tide level and the low temperature provided good cooling efficiency. The flow ranged from an average of 5000 gallons/minute to 9000 gallons/minute in the summer. A disadvantage of using this water source was the high concentration of chloride and dissolved solids. However, corrosion was less of a problem than buildup of scale in cooling equipment. As a result, the cooling equipment had to be oversized and mechanically cleaned of scale about every two years. The use of once-through cooling water had another advantage for the Linden plant, but it came at the expense of the environment. The wastewater effluents from production were combined with the spent cooling water in a common sewer and returned to the Arthur Kill without any treatment.[77]

Some renumbering of the Linden buildings had taken place in 1946. Those engaged in dye and allied organic chemical production were designated numbers 1 to 99, administration buildings were numbered 100 to 199, and buildings that manufactured products other than dyes were numbered from 200 on. Two letters followed the numerals. The A, B, and C blocks, from south to north determined the first letter. Then the entire tract of buildings was divided into sections running from west to east, which determined the second letter.

Reppe Acetylene Chemistry in America

In May 1946, president Burpee announced that work had commenced on a new US$1,250,000 building at Linden that would serve as a semi-works and pilot plant for the manufacture of chemicals from acetylene. This was the first unit of its kind in the USA. The two-storey building, according to the numbering scheme, was No. 204 (or 204AA, with the two letters added), located on a vacant area at the south of the A block. Some 640 piles supported the foundations. One of the two wings was made available to the Process Development Department and the other to the New Products Development Department.[78] The building incorporated a reinforced explosion-proof stall for high-pressure acetylene experiments (Figure 3). The acetylene was produced from calcium carbide in a nearby building, because natural gas was then considered too expensive as a source.

Acetylene-derived chemicals represented a major technology breakthrough for General Aniline and became an outstanding commercial success. The basic research for safely reacting the highly flammable gas with other chemicals at high pressures was done by J. Walter Reppe at I. G. Farben from the late 1920s.[79] In England, ICI had undertaken similar work in the 1930s, but did not advance beyond a small-scale process.[80] General Aniline acquired the Reppe acetylene inventions in the last batch of 850 patents received from I. G. Farben in 1940. The Easton laboratory developed syntheses for 30 products that showed potential commercial applications.

The starting point for many of these products was the reaction of acetylene under pressure with formaldehyde to form butynediol. This was reduced to butenediol and then to butanediol. During World War II, Linden produced small quantities of two acetylene products for the military, Polectron and Koresin. Polectron was poly(vinyl carbazole), also made in Germany as Luvican. The Grasselli product was useful in electronics, for insulation and where high operating temperatures were employed. It was similar to styrene but had improved heat resistance; mass polymerization gave almost clear glasslike castings. However, for peacetime use it suffered from high cost, lack of uniformity, poor colour and poor mechanical properties. Copolymers of vinyl carbazole and styrene were found to have good moulding properties. Koresin, also first developed in Germany, was a condensation product of acetylene and *p-tert*-butyl phenol, and was a very effective tackifier for GR-S synthetic rubber. John W. Copenhaver at Easton was one of the leading GAF experts in acetylene chemistry and with Maurice H. Bigelow, affiliated with the Plaskon Division, wrote the authoritative volume on the subject, following extensive investigations in post-war Germany.[81]

The most important product arising out of the acetylene work at Grasselli was vinyl pyrrolidone, originally discovered by Reppe's group at Ludwigshafen (Figures 4 and 5). It was the monomer for poly(vinyl pyrrolidone), a white powder, soluble in both alcohol and water, that served as a valuable blood plasma extender, made first in Germany in 1942 and during the early 1950s at Linden. It formed transparent films on glass, plastics and metals, and found application in the formulation of cosmetics, particularly hair sprays. The polymer known as Polyclar, was manufactured at Linden until the 1980s and the copolymer Gafquat 755 until 1991.

The marketing of vinyl derivatives and polymers was taken over in 1952 by Jesse Werner, when he was appointed director of commercial development (a post he held until 1959, when he was appointed vice president of the corporation). A US$6 million acetylene chemicals plant at Calvert City, Kentucky, came on stream in 1956. Linden's Hans Beller, who had earlier cooperated with Easton in acetylene products research, was project director during the construction phase and the first plant manager.[82] The technology was difficult and there were two serious explosions in the early years. However, General Aniline was the only producer in the USA, at least until the Dow-BASF process was introduced in 1958. The Calvert City plant lost money until 1962, when the business became highly profitable, with gross profit margins in excess of 50

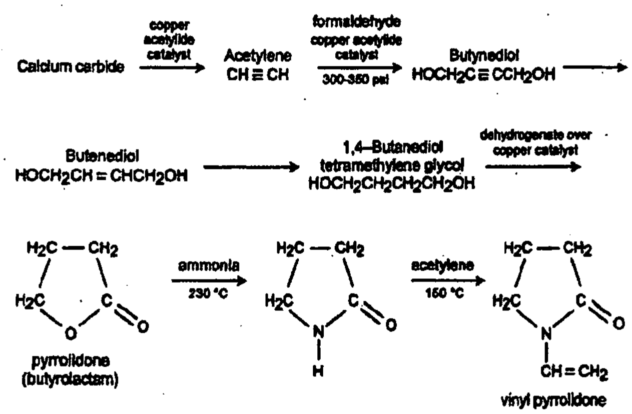


Figure 4 Scheme for Synthesis of Vinyl Pyrrolidone from Acetylene.

Figure 5 Distillation of Vinyl Pyrrolidone in High Pressure Preparations Laboratory, Easton, 1952. Photograph by Russell C. Aikins, Urban Archives of the Samuel Paley Library, Temple University, Philadelphia. (Every effort has been made to trace the current copyright holder; the authors will be happy to make arrangements with whoever holds the copyright, should they come forward.)

per cent on production costs beyond the breakeven volume.[83] A second acetylene chemicals unit was built in Texas City, Texas, in 1968 to fill the demand for the many new applications of the products. The acetylene was produced from petrochemical fractions. Elsewhere acetylene-based syntheses had been replaced mainly by those based on ethylene, also used in the production of an important Grasselli product, ethylene oxide.

Detergents and Surfactants

Another outcome of wartime work was the consumer-oriented liquid detergent Glim, made at Linden and marketed from 1946, though the company lacked the sales expertise and cash to enable growth of this product. Also, manufacture depended upon a process for synthesis of ingredients covered by a patent held by Rohm & Haas. In 1948, General Aniline sold rights to B. T. Babbitt Inc. and from then on made the detergent base for the wholesale market.

A more significant development at Linden in the 1940s was the production of Igepal non-ionic surfactants by the reaction of alkyl phenols with ethylene oxide. During 1950–51, surfactant production was undertaken on a large scale at both Linden and Rensselaer as part of a US$2 million project.[84] In 1956, General Aniline drew up plans to produce at Linden on a larger scale the Igepals and the sulphated anionic derivatives called Alipals. This included manufacture of the ethylene oxide and alkyl phenols. A US$8 million surfactants plant was constructed in 1957, including an ethylene oxide unit, located at the western end of the site, based on the Scientific Design Co. process and rated at 60 million pounds per year capacity. It was also equipped to manufacture ethylene glycol for the anti-freeze and fibre markets as well as diethylene glycol. The ethylene was delivered by pipeline from the nearby Bayway Refinery of Esso Standard Oil. A second surfactant unit was built the same year on part of the 55-acre Calvert City plant site.[85] Ethylene oxide products now covered Igepal, Emulphor, Peregal and Diazapan textile auxiliaries that included emulsifiers and a range of dispersing, wetting and cleaning agents.

Decline in Business

Corporate sales had reached a peak of US$73 million in 1944 with a net operating profit of US$3.5 million after taxes. During 1945–46, however, and despite growing demand for and output of chemicals, the corporate financial performance declined and there were indications of serious problems within the company. The General Aniline Works Division sales were 50–55 per cent of the corporate total but contributed 80–90 per cent of the total profit. In 1946 corporate sales slipped to US$63.5 million with net operating profit of US$2.7 million. It was only the elimination of excess profits taxes that saved the company from a disastrous financial performance. The profit shortfall was even more obvious when compared to General Aniline's three major competitors, whose 1946 profits increased 40–45 per cent in one of the best years ever for US industry. It is instructive to consider how this situation arose, particularly as a result of the changes in ownership.

One major problem was that the control of General Aniline by I. G. Farben during the 1928–41 period created inherent weaknesses. Things worked well when the parent company supplied a steady stream of patents, new products, intermediates, manufacturing processes, machinery and executive and technical staff. When in 1942 this link was broken, General Aniline struggled to become an independent company. Setting up an effective research organization and hiring capable US managers to run the plants was a slow process because of the manpower shortage during World War II. In terms of production capabilities, the company always lacked the raw material integration of its competitors and had to purchase large volume starting materials from them. By the mid-1940s the General Aniline plants were relatively inefficient and did not measure up to the best US chemical industry practices. A glaring example of lack of action was in handling of wastewater, where the Linden plant discharged untreated effluent to the Arthur Kill. General Aniline's competitor, American Cyanamid, at Bound Brook, New Jersey, had invested US$0.5 million in a multi-stage wastewater treatment plant in 1940 to meet state standards.[86]

Another legacy of I. G. Farben that burdened General Aniline's costs was GDC, its exclusive selling agent whose stock was also seized by the government. GDC had a perpetual contract to sell all dyes and chemicals, charging General Aniline a 15 per cent commission. The sales commissions cost it US$6 million in 1946. GDC operated out of an expensive nine-storey headquarters/warehouse building that it had erected in Manhattan before the war.[87] It scheduled plant production and totally controlled customer relations, disconnecting plant personnel from important feedback.

concerning the quality and performance of products. This separation also meant that when General Aniline sold its products directly to users, it could not use the trademark names of GDC. The outcome was Antara Products, from 1951 known as Antara Chemicals.[88] The government purchased GDC stock from the shareholders, mainly Halbach, in 1945, and in 1953 the Justice Department merged the company into General Aniline & Film Corporation.[89] By that time the acronym GAF was in general use, including on the railroad tank cars that shipped vinyl pyrrolidone.

The second major problem facing General Aniline was continued government control. Plans to privatize the company were stalled when Interhandel, the Swiss successor to I. G. Chemie, sued the US government in 1948 to recover the stock. Interhandel claimed the dividend/option agreement with I. G. Farben had been cancelled in 1940 and that the USA had illegally seized the assets of an independent firm headquartered in a neutral country. The case would be argued in the US and international courts for years. During government ownership, General Aniline could not raise capital through a stock issue or use company stock for a merger to grow and diversify its businesses. In 1945, General Aniline borrowed US$10 million from a group of banks and in 1947 secured a US$15 million insurance company loan from Metropolitan Life for capital expansion. In 1947, two major competitors, Du Pont and American Cyanamid, raised US$125 million for their expansion plans.

Government ownership also resulted in a weak top management. The president and directors positions were often filled according to political patronage and turnover was extremely high. During 1939–47 52 men served in directorship positions. Many of the top executives lacked chemical industry experience. Some had other businesses and worked only part time. The focus was on short-term operational performance; strategic planning to assure the success of General Aniline had a lower priority. Decision making was paralyzed by executives who feared the loss of their jobs if, and whenever, the government sold the company. Between 1942 and 1952, some 82 executives departed. As a result there was very little of the sort of risk-taking that would probably have enabled the company to grow at the same rate as its competitors. A good example of the lack of confidence happened after a chemist at Easton, V. Tulagin, invented a new dye system for colour photography. His boss, Dr Carl Barnes, viewed the discovery as superior to the Kodak system. Barnes presented details to the company president but it was rejected, since management could not believe that a chemist in the Easton laboratory could beat Kodak. Barnes quit General Aniline and would later become vice president of research at Food Machinery & Chemical Company (FMC Corporation). Acetylene specialist Copenhaver left Easton to join the chemical engineering firm W. M. Kellogg in 1949. Many other promising young scientists hired in the early 1940s resigned a few years later when it became obvious that their inventions would not be commercialized.[90]

Revival: A Chemicals Strategy

The period of decline came to an end with the appointment of dynamic new management figures. First was Jack Frye, who in 1947, as president of Transcontinental and Western Air (later TWA), was fired by Howard Hughes. Frye used his political connections to land the top job at General Aniline, chairman of the board, in April 1947. Burpee was re-elected president of the company at that time, when General Aniline employed 9500 people, including at the Ansco and Ozalid divisions. Although Frye had no chemical industry experience, he proved to be a very capable executive during his 8-year tenure. Sales and profits rebounded to record highs in 1948. A year later, Frye brought in John C. Franklin, also previously at Transcontinental and Western, as vice president. They both left General Aniline in 1955.

Demand for dyes was still growing. The Linden plant operated 24 hours a day, 7 days a week, with three shifts each day. In May 1949, it employed 2365 people and was the largest producer of vat dyes in the USA, which was now the main dye-manufacturing country in the world and would remain so until 1970.

Rensselaer also participated in the expansion of chemicals production. Rensselaer pioneered the manufacture of optical brighteners, as invented at I. G. Farben before the war, under the Blancophor trademark for the textile industry. Several ultraviolet absorbers were also produced under the trademark Uvinul. These products, mainly benzophenone derivatives, protected plastics and coatings from deterioration by light.

Frye, however, saw the main growth opportunities in chemicals other than dyes, where the integration advantages of Du Pont, National Aniline (Allied Chemical and Dye Corporation), and American Cyanamid, all manufacturers of primary intermediates, could not be overcome. In keeping with this strategy, General Aniline in 1951 borrowed a further US$10 million from Metropolitan Life to fund capital expansion projects in acetylene chemicals and surfactants and the installation at Linden of electrochemical mercury cells for production of chlorine and caustic soda.

General Aniline had significant requirements for chlorine and caustic soda in the manufacture of dyes, intermediates and chemicals at Linden and Rensselaer, in addition to a strong merchant market in the northeast. A US$5 million unit came on stream in 1955 at Linden with a capacity of 50 tons of liquefied chlorine per day. The operation was very profitable and daily capacity of chlorine was increased to 235 tons by 1963.[91] Further expansion was based on new BASF technology that was untested, at least in the USA. It took until the end of the decade before the new unit came on stream, following extensive work by the Krebs firm of Paris, France.

In 1955, General Aniline moved the director of the Central Research Laboratory, Dr Joseph W. Lang, to Linden. The purpose was to improve communication with the plants and the marketing office in New York during a period of rapid expansion. Dye research was transferred from Easton to Linden and Rensselaer depending on the products involved. Lang remained director of the Easton laboratory, where research in the fields of acetylene chemistry, surfactants and analytical methods continued.[92] The research functions for the Ansco and Ozalid divisions had been moved to their respective plant sites in Binghamton and Johnson City, New York, several years earlier.

In the late 1950s–early 1960s period, General Aniline increased its activity in the pigments market.[93] The growth of the pigments business led to the construction of a new unit for phthalocyanine manufacture at Linden in 1966.[94] The main products were restricted to Heliogen blue and, by chlorination, green, despite earlier attempts at Easton to extend the colour range. At the close of 1964, General Aniline had about 550 employees engaged in research and development; over 200 were chemists, physicists, and engineers holding 'more than one college degree'.

General Aniline is Privatized

Government ownership probably made it easy for private firms to poach General Aniline staff with promises of more lucrative financial packages. Phillip Kronowitt, who in 1947 had represented the US government on one of the last Field Intelligence Agency, Technical (FIAT) investigations of German dyestuff manufacturing, and some other Grasselli chemical engineers and chemists, in addition to Max, left to join Ciba at Toms River at the end of the 1940s. In 1952, they were joined, as head of research and development, by organic chemist Philip Wehner, who had worked at Easton during 1942–45, and then at the University of Chicago, under an arrangement with the Atomic Energy Commission. In 1968 he was appointed president of Toms River Chemical Corporation. In 1953, thirteen General Aniline employees, unhappy with the political appointees, including those from airlines and the entertainment world, left to join Ernest Halbach at Verona Chemical Company (recently purchased from General Aniline, following its earlier ownership by GDC) and establish Verona Dyestuffs, a division of Verona Chemical. General Aniline filed suit against Halbach, claiming US$6.2 million in damages for use of confidential information and trade secrets acquired by former employees.[95] The suit was discontinued in 1954.

After a two-decade legal battle over the ownership of General Aniline, the Justice Department reached an agreement with Interhandel in March 1963. The government therefore gave some credence to the claim that the ties to I. G. Farben were severed in 1940. The stock was sold to the public in 1965 for US$328 million with Interhandel receiving US$122 million.[96]

The financial performance in 1965 set a record, with sales of US$215.5 million (a 12.1 per cent increase over 1964) and net income of US$13.2 million (a 23.1 per cent increase over 1964). All four product lines, dyes, chemicals, photo, and reprographic products, showed good improvement. In 1964, Werner had split General Aniline into two divisions, one covering dyestuffs and the other non-dye chemicals. The dye range of over one thousand individual dyes generated the highest ever levels of sales. New dyes were added for nylon, acrylic, and polyester synthetic fibres. The GDC slogan 'From Research to Reality' accompanied advertisements for novel dyes such as Genacron for Dacron polyester, and Genacryl for Acrilan. The surfactant line, consisting of a dozen chemical types and four hundred products, was expanded at both Linden and Calvert City, and the company became one of the largest producers in the USA. New formaldehye and methylamine units were built at Calvert City to support the growing acetylene chemicals business.[97]

A Personal Impression

In 1966 one of the authors (RB) had a summer job at the Linden plant as a control chemist in the Vat Color Department. It was a wonderful learning experience from the first day, with Dr John Taras, department head, demonstrating the dyeing of cotton with Indanthrene blue. The sprawling plant manufactured a huge range of dyes, intermediates and chemicals. A young chemist could see in practice virtually every type of chemical reaction: nitration, reduction, sulphonation, halogenation, caustic fusion, alkylation, ring closure, etc. Both commodity and specialty chemicals were being produced with modern continuous processes and classical batch operations. The easy access to research chemists with years of experience, engineers, and a well stocked reference library was very helpful in troubleshooting quality and yield problems in the manufacturing units.

At this time, however, I saw that fundamental changes in the dye business were already underway. Intermediates from Europe could be imported at lower cost than manufacture at Linden, resulting in some capacity being shutdown. The company recognized that its surplus batch equipment, coupled with its vast know-how of organic synthesis, could be used for the contract manufacture of high value specialty chemicals. An agreement had been made in 1962 with Amchem Products, an agricultural chemicals company in Ambler, Pennsylvania, to manufacture Amiben (3-amino-2,5-dichlorobenzoic acid), a pre-emergent herbicide used to control weeds in soybean cultivation. In 1966 I observed its production in a surplus pilot plant and was informed the business was very profitable for General Aniline. Amiben was a skin irritant and some chemical operators developed serious body rashes working in the unit. Area ventilation was improved and increased personal protective equipment was used. A long-term supply agreement was later signed with what had become Rorer-Amchem and General Aniline built an Amiben unit at its new Texas City, Texas, plant in 1968. Amchem purchased the unit for US$12 million in 1970 and gave General Aniline a long-term contract to operate it. The net gain for General Aniline was US$2.4 million.[98]

In 1968, Calvert City introduced new production units for vinyl ether copolymers and their derivatives, enabling increased sales of Gantrez copolymers used in detergents. These products were also made at Linden. In 1969 a multi-million dollar expansion program began at Texas City, completed in 1971. The products included propargyl alcohol, 1,4-butynediol, and 1,4-butanediol. There was also growth in production of Polyclar, a polymer of vinyl pyrrolidone then made at Calvert City. Tetrahydrofuran, or THF, made from butanediol, was produced at Texas City and refined for the northeast market at Linden. GAF, now the world leader in acetylene chemistry and since privatization free to trade with successors to I. G. Farben, in 1975 set up a joint venture with Chemische Werke Hüls AG at Marl, in the Ruhr district of West Germany, to manufacture butanediol and THF. In the USA, ISP Corporation, successor to GAF, continued to produce butanediol until 2000.

Labour Relations

After the war, General Aniline experienced difficult relations with its labour unions. In 1946 the Rensselaer plant was shutdown for several days when 800 production workers walked out. The employees, members of the International Chemical

Workers Union, protested a company appointment they believed violated the labour contract.[99] A strike at Rensselaer in 1949 was settled when workers accepted a 3.6 per cent pay increase, bringing their average wage to US$1.73 per hour.[100] At the Linden plant in the same year, employee morale was lowered by plant manager Russell Baker's announcement of a layoff of 300 production and other employees because of slow sales. The plant employed 2365 at the time.[101] Tensions increased further in 1950 when Linden plant management fired a worker who gave a false excuse for taking a day off. During a televised baseball game on that day, the worker was seen sitting in the stands by a manager watching television. The General Aniline Employees Organization, an independent union, ordered its 2400 members to walk-out in protest at the firing.[102] Workers at both plants struck frequently throughout the history of General Aniline to obtain higher pay, improved benefits and better working conditions.

Although the General Aniline dye plants did experience periods of good safety performance, with no lost workday injuries for two million man hours or more (for which in 1964 the corporation received the Lammont du Pont Safety Award of the Manufacturing Chemists' Association), their overall safety performance was inferior to Du Pont, which set the standard for safety in the chemical industry. The Linden plant experienced several incidents in the 1958–79 period that resulted in the deaths of seven workers. The level of process engineering was below best practices of the chemical industry at the time and the safety programme was more reactive than proactive.

GAF Exits the Colorants Business

The strategic direction of General Aniline took a significant turn in 1967, when the Ruberoid Company was acquired for about US$113 million. This major entry into the building materials market signalled a lower priority for the dyes business. The company further distanced itself from its heritage by changing its name from General Aniline & Film Corporation to GAF Corporation in 1968. These changes were led by Jesse Werner, appointed chief executive officer by Attorney General Robert Kennedy in 1961. Werner was the first scientist to head General Aniline and in 1965 become president, and soon after chairman of the board, of the privatized corporation.

In 1968, sales of colorants were averaging US$40 million annually and General Aniline was second only to Du Pont in this sector. US vat dye production in 1969 exceeded 23,036 tons, of which GAF was responsible for around one quarter. However, the Kennedy round of tariff negotiations concluded in 1967 had introduced cuts in duties on imported dyes and pigments. This took place at the rate of a 10 per cent cut each year over five years beginning in 1968. It slowed down, but did not altogether stop, research into colorants for synthetic fibres, plastics, paper and printing inks, though General Aniline completely neglected fibre-reactive and heat transfer dyes. The former, introduced by ICI in 1956, soon threatened the market for vat dyes. In 1968, Edwin R. Cowherd, vice president of GAF, testified at a Congressional hearing on tariffs that 'The cut in the tariffs that has already occurred as a result of the Kennedy Round, and the prospect of the cuts yet to come, have caused us to greatly accelerate the elimination of dyestuffs and pigments from our line.'[103]

The surfactants, however, saw considerable expansion. Phosphate ester surfactants had been manufactured at Linden from 1958. Around a decade later, Linden modified the manufacturing equipment with the intention of providing improved quality, lowering costs and increasing capacity. The new chlorine-caustic unit that had been dogged with teething problems began operation early in 1970.

In 1970, Jesse Werner announced that 1969 consolidated net sales rose 6 per cent over the preceeding year to US$606,254,000. Chemicals represented 26.9 per cent of the total. However the rate of sales growth had fallen due to intense competition. There were extraordinary write-offs primarily as a result of the scheduled closing of two operating facilities, one a dyestuffs intermediate unit at Linden. Competition had reduced sales and profitability of dyestuffs.[104] Growing textile imports slowed demand for dyes in the USA. These factors lowered selling prices and profits for the US producers. In 1973, the Justice Department charged the major producers, including GAF, with price fixing, which resulted in US$15 million in fines.[105]

All US dye makers had cut research expenditures because of rapidly declining profits. During the period 1961–80, non-US companies were issued 700 US patents in the new disperse dye class compared to only 292 issued to US companies.[106] GAF obtained its last disperse dye patent in 1970. After 30 years of discoveries in all fields of chemistry, the Central Research Laboratory in Easton was closed in 1972. Research and other corporate functions were then consolidated in the Wayne, New Jersey, complex that GAF purchased from Uniroyal Corporation in 1969.

New environmental regulations, introduced from 1970, forced GAF to make major wastewater treatment and air pollution control investments at Linden and Rensselaer. By 1977 the company had borrowed US$14 million for these projects, with US$10 million allocated to Linden primarily for a new biological, or activated sludge, wastewater treatment plant, located at the east of the plant, close to the Arthur Kill.[107]

In mid-1977, GAF announced plans to withdraw from the dye business altogether. In January 1978, the company came to an agreement in principle to sell the Rensselaer plant to the newly formed Rensselaer Color Corporation.[108] Just before the deal was closed, Rensselaer Color made a forward looking presentation to Rensselaer plant employees on a Friday. But when employees came to work the following Monday, they were surprised to learn that BASF had put the winning bid together over the weekend.[109] The sale was finalized on 31 March 1978 and involved approximately US$21.2 million in cash for inventory and accounts receivable and a US$2.5 million note. GAF retained responsibility for debt service on US$3.1 million in pollution control bonds. BASF assumed certain other pollution control obligations. The sale included the buildings, equipment and GAF patents.[110] It represented the beginning of a consolidation phase of the market.

The Linden plant had already started to shrink in 1972 with the spin-off of the chlorine–caustic soda operation to Linden Chlorine Products, or LCP Inc., headed by Christian Hansen, a former GAF executive. In 1978, all GAF production ceased except for some photographic dyes and surfactants, but these lines were eventually shut down or sold to other companies. The surfactant business, that represented some 90 per cent of remaining GAF Linden production (the rest was refining of tetrahydrofuran, and production of Gafquat copolymers for detergents), was sold to Rhône-Poulenc Specialty Chemicals in 1990. The Linden site was operated for Rhône-Poulenc products until April 1991 and was then shut down. In 1989, Samuel J. Heyman, CEO of GAF Corporation since 1983, engineered a leveraged buyout and GAF became a private concern. In 1991 it became the publicly owned ISP (International Specialty Products) Corporation. GAF was spun off as a roofing material specialist.

In the mid-1980s, the New Jersey Hazardous Facilities Siting Commission tried to site a hazardous waste incinerator in New Jersey. After the Commission rejected several proposed locations, GAF recommended the hazardous waste incinerator be located at its near-dormant 145-acre Linden site. It offered to build the US$80 million, 65,000 tons a year incinerator, which was claimed to have a combustion efficiency of 99.99 per cent.[111] Neighbourhood opposition to the incinerator plan was vociferous. Residents of the Tremley Point area, living in the homes originally built after World War I by the Grasselli Chemical Company, were especially concerned with health impacts. The residents were now better educated, represented new ethnic and racial groups and were no longer dependent on the nearby chemical industries for their livelihoods. GAF and its successor company ISP Corporation, latterly through ISP-Environmental Services, fought for 12 years but failed to obtain the permit for the hazardous waste incinerator. In 2001, the Hazardous Waste Facilities Siting Commission concluded that New Jersey did not need an incinerator after all. The closure of many chemical plants in the state had significantly reduced the generation of hazardous waste.[112]

In 1989, GAF signed an Administrative Consent Order with the New Jersey Department of Environmental Protection to fund a US$7.5 million study of the pollution problems at the site.[113] New Jersey alleged the company violated the Water Pollution Control Act and the Spill Compensation and Control Act by poor manufacturing practices over many years. GAF said it operated in accordance with applicable laws at the time.

Twenty-two old General Aniline buildings remained empty at the site for years. The last three were demolished with explosive charges in 2003.[114] The ISP remedial action plan included a steel barrier, 18–20 feet deep, in the ground to control shallow groundwater. Deep wells were installed to prevent off-site migration of pollution and the site has been capped with fill material.[115] After spending US$37 million on the cleanup, ISP hopes the site can be redeveloped as a distribution center. The chlorine–caustic soda operation was based on old mercury cell technology, which resulted in heavy pollution of soil, groundwater and a nearby creek with mercury. LCP went bankrupt and its site is scheduled to be remediated under the Superfund scheme.

BASF shutdown the Rensselaer plant in 2000 and moved dye production to Mexico and Germany. After 118 years of continuous operation, apart from a few months in 1915, the plant whose dyes had coloured Windex glass cleaner blue, fiberglass insulation pink and telephone pages yellow was gone.

Conclusion

When the Grasselli Chemical Company began the manufacture of synthetic dyes in 1915, it was to satisfy the strategic and consumer needs of a world at war. There was no time for analysis or assessment of technologies and even less for understanding the underlying chemistry. This brought profits at first but problems once the war was over, as demand and prices collapsed. German firms had been the leaders in this business and during the 1920s provided the answers to survival capabilities, based on markets and technologies, as well as mutual needs. I. G. Farben enabled the General Aniline Works, later General Aniline & Film, to become a major manufacturer of synthetic dyes in the USA, and certainly the leader in vat dyes, and a force to be reckoned with in azo and sulphur dyes, as well as in surfactants. Then, under the ownership of the US government, research focused on new strategic requirements, particularly involving high-pressure acetylene (Reppe) chemistry. A whole new area for diversification became available. Despite two major changes of ownership, the German conglomerate, that withheld knowledge, and the US government, with its political appointees, General Aniline managed to develop novel products and make them available in the largest consumer and industrial market in the world.

It was not so much the transfer of German technology that made this possible, but, as historians Peter Morris and Raymond Stokes have observed, the availability of details of German inventions.[116] General Aniline had an initial advantage over other US firms, that had to rely on post-war Allied investigators, because of the 1940 patent agreement with I. G. Farben. Even then the path from patents to products was not smooth, though the research sometimes afforded unexpected but profitable outcomes. A good example is in a 1945 report by Easton's research leader Hanford on one aspect of acetylene chemistry, the polymerization of vinyl ethers: 'We suspected and subsequently found that the reaction did not proceed by the mechanism given in the patent. We also found that the reaction had much wider application than is covered by the patent.'[117] This is why the outcome of this and similar episodes, both before and after 1942, can best be understood through technical detail, thereby contributing to the story of the fate of I. G. Farben chemistry in the USA and, as Peter Hayes has described it, 'toward recovering particular states of the art at given moments.'[118]

The Linden and Rensselaer plants were both closely associated with dyestuffs, and until the late 1960s they were generally successful in that sector. The subsequent rapid loss in market share arose from several factors and not just the reduction in tariffs. They included the facts that: there was a shift towards building materials in 1967, following the acquisition of Ruberoid (sometimes referred to as a merger); research spending was cut, which hampered the development of new dyes needed by the textile industry; and environmental control investments were mandated by the new EPA regulations. Then of course there was the prospect of greater profits to be had from quite different markets, often satisfied by diversification based on what had originally been I. G. Farben inventions.

Today GAF is a major manufacturer of roofing materials that sees its long heritage in Ruberoid, founded in the 1880s. ISP, owner of the vacant site at Linden, is a major international manufacturer of specialty chemicals, including of surfactants and products that arose from research into acetylene chemistry and special-purpose iron powders. In many ways this represents the chemical legacy of I. G. Farben in the USA.

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Notes

[1] Michael C. Jensen, 'A Fuzzy Picture at GAF,' *New York Times*, 31 July 1977.
[2] Haynes, *Chemical Pioneers*, 88–107. For the early history of Grasselli Chemical Company, see the 1927 manuscript of Caesar A. Grasselli, http://atkeson.net/history/ (accessed 6 October 2005).
[3] A Huguenot named Traubels settled on the peninsula in the 17th century, changing his name to Trembley. Over time the area's name became known as Tremley. Ken Serrano, 'A walk around the block: Tremley Point reeks with shades of history,' *Home News Tribune* (East Brunswick, NJ), 20 February 2003.
[4] 'Chemicals. A Great Industry: Enormous Earning Power,' stock offer advertisement by White & Co. Inc., *The Syracuse Herald*, 6 December 1916; 'Business News,' *Washington Post*, 26 January 1917.
[5] Haynes, *American Chemical Industry*, vol. VI, 174–7.
[6] Steen, 'Wartime Catalyst.'
[7] Norton, 'A Census.'
[8] Hesse, 'Coal-Tar Dye Industry.'
[9] Haynes, *American Chemical Industry*, vol. VI, 174–7.
[10] Farnaz Fassihi, 'The Battle of Tremley Point,' *Star Ledger* (Newark, NJ), 19 December 2000.
[11] Stone, 'Aniline Dye Situation.'
[12] 'Good Khaki Color Assured for Army,' *New York Times*, 22 April 1917.
[13] 'Names in the News,' *American Dyestuff Reporter* 41, no. 6 (17 March 1952): 181.
[14] 'American-Made Colors,' *American Dyestuff Reporter* 11, no. 12 (4 December 1922): 411–13.
[15] Donahue, 'Rensselaer;' Steen, 'Wartime Catalyst,' 264; Wilkins, 'German Chemical,' 290–2.
[16] ENSR, 'Article X.'
[17] Paul Grondahl, 'The Hudson River Chronicles,' *Times-Union* (Albany, NY), 13 September 1998.
[18] 'Detergent, Emulsifying, Finishing and Wetting Agents,' *American Dyestuff Reporter* 26, no. 19 (20 September 1937).
[19] Anderson and DeLawyer, *Chemicals, Metals and Men.*
[20] Norton, 'Tar Products and Dyestuffs.'
[21] Hendrick, 'Record of the Coal-Tar Color Industry.'
[22] 'German Plot for After-War Trade Bared by Palmer,' *New York Times*, 22 August 1918.
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[24] 'Arrest of Dr. Rudolph Hutz,' *New York Times*, 22 August 1918.
[25] Kenneth Aaron, 'Death of a Dye Plant Ends Long History,' *Times Union* (Albany, NY), 30 December 2000.

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[27] 'The Bayer Company Sale,' *American Dyestuff Reporter* 3, no. 23 (2 December 1918): 3-7.
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[29] Ricard, 'History of the Dye Producing Industry.'
[30] 'Why U.S. Dye Makers Gave Up,' *Chemical Week*, 8 September 1982, 55.
[31] Verg *et al.*, *Milestones*, 208.
[32] Schmidt, 'Foreign Trade Strategies.'
[33] 'Production and Sales of American Dyes Increased in 1925,' *American Dyestuff Reporter* 15, no. 7 (3 May 1926): 288–9.
[34] 'Grasselli Company Claims To Be Losing on $4,500,000 Dye Investment,' *Chemical and Metallurgical Engineering* 26, no. 13 (29 March 1922): 610.
[35] Watson, 'Progress in the Domestic Manufacture.'
[36] 'The Grasselli Dyestuff Corporation,' *American Dyestuff Reporter* 13 (30 June 1924): 439.
[37] 'Dye Invasion Feared,' *Indianapolis (Indiana) Star*, 23 June 1924.
[38] Haynes, *American Chemical Industry*, vol. VI, 183–5; Wilkins, 'German Chemical,' 306–8.
[39] Donahue, 'Rensselaer;' Ricard, 'History of the Dye Producing Industry.'
[40] Ricard, 'History of the Dye Producing Industry;' Ney and Van Marle, 'Processes.'
[41] Hager and Marsson, 'Developments in the Naphtol AS Series.'
[42] Rath, 'New Developments in Naphtol AS.'
[43] Haynes, *American Chemical Industry*, VI, 174–7.
[44] 'Mills and Men,' *American Dyestuff Reporter* 16, no. 15 (5 September 1927): 574.
[45] 'List of Products Manufactured by Grasselli Dyestuff Corporation,' *American Dyestuff Reporter* 17, no. 2 (26 February 1928): 99–100.
[46] 'Names In The News,' *American Dyestuff Reporter* 45, no. 25 (3 December 1956): 931.
[47] 'Wall Street Briefs,' *The Decatur (Illinois) Review*, 15 November 1928.
[48] Draves, 'Manufacture of Anthraquinone Vat Dyes.'
[49] Bishop and Sachs, 'Progress in the Development;' 'National Produces Three Vat Colors,' *American Dyestuff Reporter* 16, no. 22 (26 December 1927).
[50] 'Our Dye Output Set New Records in 1928,' *American Dyestuff Reporter Sample Swatch Quarterly*, 15 April 1929, 243–5.
[51] 'New Indanthrene Made By General Aniline,' *American Dyestuff Reporter* 18, no. 10 (10 June 1929): 404; 'New Indanthrene Blue Announced,' *American Dyestuff Reporter* 18, no. 11 (24 June 1929): 452; 'Announce Several New Dye Products,' *American Dyestuff Reporter* 18, no. 14 (19 August 1929): 573. The best technical account of the vat dye processes is Bradley and Kronowitt, 'Anthraquinone Vat Dyes.' As mentioned in the text, Kronowitt worked at Linden until the late 1940s, when he joined Ciba States.
[52] *I.G. Farbenindustrie Aktiengesellschaft 1930*, Frankfurt am Main (annual report), 13, 14, 16, 25–6, 38; 'General Aniline & Film,' *Fortune* 36, no. 2 (August 1947): 68–73, 148–53.
[53] Glaser-Schmidt, 'Foreign Trade Strategies.'
[54] Reader, *Imperial Chemical Industries*, 332.
[55] Hounshell and Smith, *Science and Corporate Strategy*; Travis, *Dyes Made in America*.
[56] For amino resins, see Travis, *Dyes Made in America*, 115–24.
[57] Kastens and Ayo, 'Pioneer Surfactant.'
[58] Lee, 'Versatility in Dyestuffs Equipment;' *Aniline Dyegest* 1, no. 7 (November 1945): 1, 5. The inhouse newsletter *Aniline Dyegest* first appeared in May 1945. See www.colorantshistory.org/AnilineDyegest.html.
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[61] Dorothy Thompson, 'On the Record,' *Syracuse-Herald Journal* (New York), 23 June 1941.

[62] 'General Aniline Head Is Out in Control Struggle,' *Syracuse Herald-Journal* (New York), 4 October 1941.
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[66] 'Nazi War Products Are Now Being Made for U.S.,' *The Charleroi (Pennsylvania) Mail*, 15 September 1944.
[67] See military history website www.redstone.army.mil/history/
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[69] 'General Aniline & Film Opens New Research Laboratory,' *Chemical and Engineering News* 21, no. 4 (25 February 1943): 273. www.colorantshistory.org/EastonCRL and www.colorantshistory/AnilogNewsletter. Available from: http://www.colorantshistory.org (accessed 20 November 2005).
[70] Leander Ricard, personal communication, March 2005.
[71] For Beller's anti-Nazi stance see transcript of interview of A. Donald Green and Willard Asbury by Peter J. T. Morris, 9 December 1985, CHF Oral History Program, Chemical Heritage Foundation, Philadelphia, 18–19; Löhnert and Gill, 'The Relationship.'
[72] Davidson and Godlove, 'Applications of the Automatic;' Travis, *Dyes Made in America*, 192–4.
[73] 'Dye Production Ample,' *American Dyestuff Reporter* 34, no. 24 (19 November 1945): 474–5.
[74] W. E. Hanford, General Aniline & Film Corporation, 'Monthly Research Letter: New Products Division and Research Division,' 14 December 1945.
[75] W. E. Hanford, General Aniline & Film Corporation, 'Monthly Research Letter,' 17 January 1946.
[76] *Aniline Dyegest* 2, no. 2 (June–July 1946): 1, 2.
[77] Kastens and Ayo, 'Pioneer Surfactant.'
[78] *Aniline Dyegest* 2, no. 1 (May 1946): 1.
[79] Morris, 'Development of Acetylene,' 115–16.
[80] Morris, 'Ambros, Reppe.'
[81] Copenhaver and Bigelow, *Acetylene*; Bigelow, 'Reppe's Acetylene;' Golding, *Polymers and Resins*, 523–7.
[82] 'News of the Trade,' *American Dyestuff Reporter* 45, no. 7 (26 March 1956).
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[85] 'General Aniline to Build Another New Chemical Plant,' *American Dyestuff Reporter* 45, no. 8 (9 April 1956): 241; 'GAF's New Surfactant Plant on Stream,' *American Dyestuff Reporter* 46, no. 16 (12 August 1957): 603.
[86] 'Calco's New Effluent Treatment Plant,' *American Dyestuff Reporter* 29, no. 25 (9 December 1940): 681; Travis, *Dyes Made in America*, 374–6.
[87] 'New General Dyestuff Building,' *American Dyestuff Reporter* 25, no. 24 (14 November 1936): 692.
[88] 'Antara Products Becomes Antara Chemicals,' *American Dyestuff Reporter* 40, no. 26 (24 December 1951): 875.
[89] 'Seized Companies Merge,' *New York Times*, 6 November 1953.

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[95] 'Baseless Charges Deplored by Frye,' *New York Times*, 21 March 1953, 24; 'Federal Unit Alleges Unfair Competition,' *New York Times*, 2 April 1953, 21.
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[104] *GAF Corporation Annual Report, 1969*, 5 March 1970.
[105] 'Why U.S. Dye Makers Gave Up,' *Chemical Week*, 8 September 1982, 56.
[106] Mock, 'The Textile Dye Industry.'
[107] GAF Corporation 1977 10-K Report, Securities and Exchange Commission, Washington, D.C.
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[110] 'GAF Dyestuffs Plant Sold to BASF,' *American Dyestuff Reporter* 67, no. 5 (May 1978): 62.
[111] 'Toxic Waste Incinerators,' *Star Ledger* (Newark, NJ), 6 August 1990.
[112] Brian Donohue and Farnaz Fassihi, 'Linden: Toxic Waste Burner Not Needed,' *Star Ledger* (Newark, NJ), 25 May 2001.
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[114] Glenn Nyback, 'N.J. Factory Demolition Causes Stir,' *Staten Island Advance* (Staten Island, NY), 10 February 2003.
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[116] Morris, 'Vom Buna;' Stokes, 'Flexible Reaktion;' and Travis, *Dyes Made in America*, 162.
[117] W. E. Hanford, General Aniline & Film Corporation, 'Monthly Research Letter: 4, New Products Division and Research Division,' 14 December 1945, 2.
[118] Hayes, 'I.G. Farben Revisited.'

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Exhibit B

CERTIFICATION

1. GAF Corporation incorporated in Delaware on April 26, 1929, as American I.G. Chemical Corporation. To the best of our information, knowledge and belief, American I.G. Chemical Corporation was owned by I.G. Farbenindustrie A.G., a German Company. The U.S. company's name was changed in 1939 to General Aniline & Film Corporation.

2. In 1942, the United States Treasury Department seized 98% of the stock of General Aniline & Film Corporation, pursuant to wartime legislation, and assumed control over company management and operations.

3. In 1965, the United States Government relinquished control over the General Aniline & Film Corporation and its stock was sold in a public offering.

4. On April 24, 1968, General Aniline & Film Corporation changed its name to GAF Corporation.

5. On July 1, 1986, GAF Chemicals Corporation was incorporated in Delaware, and all of the assets of the former Chemicals Division of GAF Corporation were transferred to GAF Chemicals Corporation.

I certify that the information furnished herein is true.

Date: May 1, 1989

Signed: Leonard Pasculli
Name: Leonard P. Pasculli
Title: Senior Counsel
GAF Corporation

Exhibit C

GAF Corporation History

Address:
1361 Alps Road
Wayne, New Jersey 07470
U.S.A.

Telephone: (973) 628-3000
Fax: (973) 628-3311

Website: www.gaf.com
Private Company
Incorporated: 1929 as American I.G. Chemical Corporation
Employees: 3,300
Sales: $850 million (1996 est.)
SICs: 2952 Asphalt Felts & Coatings; 3229 Pressed & Blown Glass & Glassware, Not Elsewhere Classified; 5039 Construction Materials, Not Elsewhere Classified; 6719 Offices of Holding Companies, Not Elsewhere Classified

Company History:

The GAF Corporation of the late 1990s essentially consists of its GAF Materials Corporation subsidiary, the largest manufacturer of residential and commercial roofing products in the United States. GAF Chemicals Corporation, a maker of specialty chemicals, was the company's other major subsidiary, until it was taken public in 1991 as International Specialty Products, Inc. (ISP), with GAF retaining an 80 percent stake. ISP was subsequently distributed to GAF shareholders in 1997, leaving GAF with no interest in its former subsidiary. GAF's rich history covers more than 150 years and includes separate ownership by German chemical giants Frederick Bayer & Company and I.G. Farben; seizures of the company by the U.S. government during World War I and World War II; a 23-year period of control by the U.S. government starting in 1942; sale to the public in 1965 in one of the largest competitive auctions in Wall Street history; a 1983 proxy takeover led by Samuel J. Heyman; being taken private in 1989; and the 1990s spinoff of the specialty chemicals operations. Heyman still owns most of GAF Corporation and remains the company chairman.

Bayer and I.G. Farben Roots

GAF had auspicious beginnings. The company was founded in April 1929, as an American arm of the enormous German chemicals trust, I.G. Farben-industrie. Known throughout the world as I.G. Dyes, the German corporation was involved in most areas of the worldwide chemicals industry, pressing forward with massive investments in research. In 1929 I.G. Dyes was classed as the largest industrial corporation in Europe. Six executives from I.G. Dyes joined with a handful of prominent American businessmen&mdash¯ong them Edsel Ford, president of the Ford Motor Company; Walter Teagle, president of the Standard Oil Company of New Jersey; Charles Mitchell, chairman of the National City Bank; and Paul Warburg, chairman of the Industrial Acceptance Bank&mdashø form the board of directors of the American I.G. Chemical Corporation.

For its plant facilities, the new corporation acquired substantial interests in Agfa-Ansco Corporation of upstate New York and General Aniline Works, Inc., which operated in New York and New Jersey. Agfa-Ansco's roots dated to a photographic supply business, the Edward Anthony Company, set up in New York City in 1842. During the Civil War, Matthew Brady used supplies from Edward Anthony to capture his famous photographs. In the early 20th century, Agfa-Ansco ranked second to Kodak in U.S. production of photographic materials and film.

General Aniline Works, formerly the Grasselli Chemical Company, had established itself as a major manufacturer of synthetic organic chemicals and dyestuffs since its founding in Rensselaer, New York, in 1882 as Hudson River Aniline Color Works Company. Hudson River was later acquired by the leading German chemical firm of the late 19th century, Frederick Bayer & Company, which renamed it the Bayer Company in 1913. This company made the first Bayer aspirin sold in the United States in 1905. The Bayer Company was seized by the U.S. government during World War I because of its German ownership and was sold at auction to Sterling Products in 1918. Sterling subsequently sold Bayer's chemical business to the Grasselli Chemical Company. After I.G. Farben acquired Grasselli in 1928, Farben changed Grasselli's name to General Aniline Works, Inc.

The plans for American I.G. were to provide competition to other American chemicals firms and to exploit the patents of I.G. Dyes in the new American market, which it did over the next decade. Initially, the company's trump card was its process for the hydrogenation of coal, which produced gasoline as a by-product; this largely accounted for the initial interest that the presidents of Ford and Standard Oil had in the new corporation. Other products that were developed and distributed by American I.G. included dyestuffs; pharmaceuticals; solvents; lacquers; photographic products and films; synthetic silk and other fabrics; a range of nitrogen products, including chemical fertilizers; and an array of other organic and inorganic chemicals.

In 1939 the company changed its name to the General Aniline and Film Corporation, after having acquired all of General Aniline Works and merged with Agfa-Ansco, of whose stock it owned 81 percent. By that time it had received approximately 3,900 patents for its vast stock of chemical formulations.

From the beginning, General Aniline was designed to be largely controlled by and dependent upon German direction and research. Almost all of its research took place in Germany, and chemical intermediates were manufactured in that country and sent to U.S. plants only for final preparation. The company's consistent success was earned through a steady performance in the fields of dyes, chemicals, and photographic products. In fact, General Aniline was the leading U.S. manufacturer of dyestuffs until du Pont caught up in the late 1930s. An acquisition that had an impact on the company's future was that of the Ozalid Corporation, a producer of copying equipment, in 1940.

Seizure During World War II

General Aniline and Film survived some early criticisms of its very existence by Americans who questioned the prudence of such a large German concern operating in the United States. The company's record was legitimate, but the direct participation in its management by German citizens had raised some cautious eyebrows on Wall Street and in Washington. Soon after it became apparent that the United States would be an active participant in World War II, General Aniline was seized by the U.S. government in February 1942, under the Trading with the Enemy Act. It was the largest asset taken over by the United States in World War II.

This move developed into a longstanding legal dispute between the U.S. government and I.G. Chemie, a Swiss holding company that was the majority stockholder of General Aniline. Prior to 1940 I.G. Chemie had been a branch of I.G. Dyes, but the company contended that it broke all relations with Germany during that year, becoming an independent corporation called Interhandel. The U.S. view was that I.G. Chemie remained a front for I.G. Dyes, despite its claims to the contrary. An out-of-court settlement between the Justice Department and Interhandel was finally reached over 20 years later--General Aniline would be sold to the public, and proceeds from the sale would be split 60 percent/40 percent, with the United States receiving the majority share.

Period of U.S. Government Control, 1942--65

Between 1942 and 1965, General Aniline was managed by government-appointed directors. It was a turbulent, minimally profitable time for the company. All told, during this period the company had seven different chief executives and over 80 directors. In several regards the government's hands were tied, preventing it from acting as freely and spontaneously as most managers could during this period. The rapid turnover of directors in itself created a barrier to long-term planning. The directors were excessively cautious, in most cases focusing on immediate rather than long-term results, never knowing when the company would be sold to the public. The pending lawsuit with Interhandel created an atmosphere resistant to risk-taking, as each potential move by General Aniline was accompanied by threats of further legal action by Interhandel. For instance, one injunction, obtained by Interhandel in 1957 in order to prevent dilution of General Aniline's equity, prohibited the company from issuing its shares for acquisitions or from entering the equity and capital markets for money with which to expand. As board president Jack Frye stated in 1953, "One of the problems of this company is that, due to its ownership situation, the management, the boards of directors, and all concerned are extremely cautious about making expenditures. In trying to avoid mistakes, they actually move more slowly than do their competitors."

Because of these restrictions, General Aniline's growth was stagnant compared to competitors in the same industries. In film and photographic equipment, the company competed chiefly with Kodak, in chemicals with du Pont, and in copying equipment with Xerox. All these firms, indeed each of the industries in question, experienced unprecedented growth and diversification through the postwar period and into the 1970s.

In spite of its cautious management and modest overall growth, General Aniline did achieve some significant successes in the 20 years after the government takeover. One bright spot was the work of the brilliant chemical engineer, Dr. Jesse Werner, who led the task of replicating the formulas of all the important compounds that were formerly produced at the parent company in Germany. A central research laboratory for the dyes and chemicals divisions was set up in Easton, Pennsylvania, in 1942, employing 400 chemists. Management was more venturesome in this area than in others and spent a good deal of money on product and market research and on the development of chemicals. These divisions produced an array of successful innovations including a chlorinecaustic plant set up in New Jersey in 1956, and the company's pioneering efforts in the field of synthetic detergents. The most important technical triumph was General Aniline's success with acetylene derivatives, a fledgling branch of chemistry in which the company's progress far surpassed its competitors'.

In the 1920s an I.G. Dyes chemist, Julius Walter Reppe, found a way of handling acetylene under pressure without explosion, something that was previously thought by chemists to be impossible. Reppe's patented processes were found in General Aniline's American vaults in 1940 and were used as a basis for research by the chemists in Easton. Some of the earliest marketable uses of acetylene-based chemicals were the PVP (polyvinylpyrrolidone) family of products, which use a white powder that is the product of the pressurized combination of acetylene and formaldehyde; some of its uses are as a blood volume expander, suspending agent, tablet binder, and a fungicide, as well as a component in cosmetics, photographic chemicals, ink, paints, adhesives, detergents, and glass.

As of 1962, General Aniline remained the sole producer of the immensely profitable acetylene derivatives in the United States. The commercial success of acetylene products can be largely attributed to Dr. Jesse Werner, who had risen through the technical ranks of the company in the 1940s, and who was named director of commercial development in 1952, charged with the responsibility of exploiting the chemists' discoveries. He implemented large-scale plans for the growing industrial uses of acetylene compounds and eventually became company president in 1962, the first chief executive of General Aniline to have worked his way up from the laboratory.

Although a large amount of money was poured into chemicals and dyestuffs research, the photography and copying equipment divisions were relatively neglected. Two discoveries by researchers in the Agfa-Ansco labs would have had a large impact on the industry, had they only received attention and funds for marketing. In the mid-1940s, a chemist named Vsevolod Tulagin invented a new dye system for color photography. His scientific peers believed it was better than what was on the market, but the business managers had little confidence that they could have a product that was of higher quality than Kodak's offerings. Then in 1951--52, Ansco developed a color movie film that was far more realistic than the super-real colors being viewed on movie screens at the time. In addition, the Ansco film could be developed within ten hours, on location, which was unheard of in the industry. Again, the circumspect General Aniline board refused to allocate the funds for an Anscofilm plant that would make production feasible.

The Ozalid division, which produced copying equipment, suffered from a similar lack of support. Its development of small office copiers and all-purpose copiers was sluggish in a booming industry, and its marketing organization was under-equipped with money and personnel. In addition, Ozalid's management was even more erratic than that of parent General Aniline; between 1957 and 1963 Ozalid had eight chief executives.

Despite all the shortcomings with Ansco and Ozalid, each maintained steady profit levels through the 1960s; the industries in which they competed were expanding rapidly, so even with decreased percentage market shares, Ozalid and Ansco could remain profitable. Ansco's concentration during this period shifted from the amateur photographic market to the commercial market, and the subsidiary handled substantial government contracts as well. As a point of interest, the camera used by the astronaut John Glenn was a modified Ansco Autoset. Ozalid's chief market share was in the engineering field; its process involving the use of diazo-sensitized paper to produce an image upon exposure to ammonia was one of the best and cheapest at the time and achieved great success in the reproduction of engineering drawings.

Sale to the Public in 1965

A benchmark in General Aniline's history came on March 9, 1965, when the 23-year control by the U.S. government ended with the biggest sale of stock by competitive bidding in Wall Street history. Dr. Werner, who had been appointed president and chief executive officer of General Aniline in 1962 and was voted chairman of the board on October 5, 1964, stood at the helm of the company as it entered this period of rebirth. He consolidated the company into two divisions: dyestuffs and chemicals, and photography and reproduction. In the 23 years since the U.S. seizure of General Aniline, its research program had earned almost 2,000 patents, and optimism for the company's future ran high.

Unfortunately, General Aniline was actually entering a new 20-year era of questionable management, during which Werner ran through a diverse roster of managers, products, and industries, which never quite panned out as his plans predicted. By the end of this period, in 1981, the firm's shares were selling for less than one-third of their 1965 offering price, and the company placed 1,004th out of 1,023 in the profitability rankings in *Forbes* magazine. Back in 1966, Werner planned to focus on growth in the company's four existing fields, because, as he said, "We have too many product lines, too much diversity for our size."

Expansion into Roofing in 1967 with Ruberoid

General Aniline's only significant acquisition during Werner's tenure was the 1967 purchase of Ruberoid Corporation, which added roofing and related products to the company's lines. This forerunner of the GAF Materials Corporation subsidiary was founded in 1886 in Bound Brook, New Jersey, as the Standard Paint Company. The year of its founding, Standard Paint introduced RUBEROID, the first ready-to-lay asphalt roofing material, which was developed by company chemist, William Griscom. This product, which achieved mass-market status over the next two decades, revolutionized the roofing industry because of its rubberlike quality and its distribution in convenient rolls. In 1898 the RUBEROID product was enhanced when Standard Paint began to embed artificially colored ceramic granules in it, improving the product's durability, fire resistance, and attractiveness.

In 1921 Standard Paint recognized the importance of its flagship product by adopting a new name, The Ruberoid Company. Ruberoid subsequently enhanced its position as a leader in the roofing industry when it introduced Tite-On Shingles in 1933. These were the first interlocking roofing shingles in the country and were much better able to withstand severe weather conditions than previously available shingles. In 1967, the year of its acquisition by General Aniline, the company introduced its Timberline Series laminated shingles, which improved the appearance of roofs and quickly became the top-selling laminated product on the market.

Struggling Through the Early 1980s

Meanwhile, the general trend between 1962 and 1982 was that research, development, and marketing outlays consistently fell short of what would have been necessary to forge market leaders for the newly named GAF Corporation (the acronym-derived name was officially adopted in April 1968). The photographic and copying business serves as a case study. This division offered a product line that was much narrower than its competitors', including no color film for its offset printers; its annual research and development expenditures averaged one percent of revenue from the division. A GAF customer observed in 1979 that "GAF's salesmen are very good, but there are just not enough of them."

Obviously, GAF must have experienced some positive feedback for its efforts or the company would not exist today. Werner's record also showed enough merit to withstand the pressures of a 1971 proxy fight, which was led by a family of stockholders who claimed he had "grossly mismanaged" the company during his career. Much of the company's profitability was the result of successes in the chemicals division, where there was consistent progress in production and sales of acetylene derivatives, surfactants (detergents), engineering thermoplastics, and mineral granules used for roofing shingles. Surfactants and acetylene products were sold worldwide to the pharmaceuticals, cosmetics, plastics, automotive, agricultural, textiles, oil and gas, paints, and paper production industries. GAF was one of only two worldwide producers of butanediol, itself an acetylene derivative, which was in turn used in the formulation of thermoplastic polyester compounds which had an enormous range of uses in the automotive, electrical/electronics, appliances, and other industries. The company also produced iron powders for the aerospace and electronics industries, products which were developed during the Werner years.

Heyman Takes Over in 1983 Proxy Fight

In 1978 Dr. Werner sold the consumer photo and processing operations, as well as the dyes and pigments interests, because of continued poor showings. This was the beginning of a massive five-year divestment program which, by the end of 1982, left GAF with only its two strongest lines, chemicals and building materials, as well as the New York City classical radio station WNCN, which the company had purchased for $22 million in June 1976 and which operated as a subsidiary, GAF Broadcasting Co. All in all, over half of GAF's assets were shed during this period. Werner had seemingly played all his cards, but just when the trimmed-down company's future again began to look bright, another proxy fight hit GAF, this one much more bitter and hard-fought than that of 1971. After a two-year battle, Werner lost out to an aggressive stockholder named Samuel J. Heyman, a real estate brokerage owner who had no previous corporate management experience.

Heyman assumed the directorship of GAF on December 14, 1983, with promises to trim all but the most profitable operations, including initial plans to liquidate the chemicals division. After thoroughly examining all of the company's records, however, he saw great potential for growth in building supplies and chemicals. He first eliminated some management positions, slashed operating expenses by 23 percent in his first nine months, and moved the company's headquarters from Manhattan to quiet Wayne, New Jersey. To instill a better sense of teamwork at the company, he decentralized management. Werner had called virtually all the shots himself, but Heyman wanted to spread decision-making responsibilities among regional and divisional managers.

The first 20 months of Heyman's leadership brought remarkable success to GAF, based primarily on cost-cutting and effective management rather than on the expansion of lines of business. Still, under Heyman capital expenditures and research and development outlays were far greater than they had been in the Werner years.

In September 1985 Heyman stated, "We have no plans to take over other companies, but we are looking at the possible acquisition of businesses that would complement our existing chemical lines." Over the following 18 months, however, GAF attempted hostile takeovers of engineering plastics and specialty chemicals concerns, Union-Carbide Corporation and Borg-Warner, and of a construction and industrial gas firm, CBI Industries. All three takeovers were ultimately thwarted, but the first two netted huge amounts of cash for GAF through the company's sale of its stock shares in the targeted firms. GAF's shares in Union-Carbide brought in close to $250 million, and the stock in Borg-Warner, purchased by eventual Borg-Warner buyer Merrill Lynch, earned $206 million for GAF. GAF's shares in CBI netted a smaller but still significant $7 million.

Typical of the new management's approach to business, Heyman steered much of these cash surpluses back into research for the building supplies and chemicals divisions. GAF sold its engineering plastics business in 1986 but remained one of only two producers of butanediol, which achieved steady increases in demand during this period. In 1988 GAF acquired Sutton Laboratories, a leading manufacturer of cosmetic preservatives.

The building materials division had been the market leader in residential roofing since the 1970s, and in the 1980s the division made major strides in the commercial roofing market. Even during the home-building lag of the early 1980s, GAF Materials Corporation was earning steady profits; then, business boomed in new home roofing, and grew even faster in premium re-roofing products designed to upgrade the appearance and value of homes. GAF led the trend toward fiberglass as well as simulated woodshake roofing products.

The 1980s culminated for GAF with the company being taken private in 1989 through a $1.4 billion highly leveraged buyout led by Heyman and 75 other members of management; only $43 million in cash was put up as part of the deal. At the time of the buyout GAF's operating subsidiaries were GAF Chemicals Corporation, GAF Materials Corporation (GAFMC), and GAF Broadcasting Co., Inc.

Transformation in the 1990s

GAF Corporation had been through innumerable changes in its long history, but the events of the 1990s altered the company like no others. By the late 1990s the company had spun off its specialty chemicals division, which had been the company's mainstay through most of its history, and was exclusively manufacturing roofing products. This transformation began in 1991 when Heyman engineered an initial public offering of GAF Chemicals, newly named International Specialty Products, Inc. (ISP). Heyman used the $285 million generated from the offering to pay down company debt, which was still high as the result of the 1989 leveraged buyout. Over the next few years, however, ISP fell on hard times, as competitors moved in to challenge the company's dominance of certain key sectors. For example, Arco Chemical built a new plant to manufacture butanediol, ISP's mainstay raw material, and was able to offer prices lower than ISP's for products made from the chemical. Likewise, in 1992 BASF began operation of a new plant in Louisiana to make hair-care specialty chemicals; its modern machinery was more efficient than ISP's outmoded equipment, leading to competitive advantages in terms of time-to-market. ISP's operating income fell almost 47 percent from 1991 to 1993, while revenues decreased four percent during the same period. By late 1994 ISP's stock had fallen almost 50 percent since the IPO.

Meanwhile, the staid GAFMC was quietly and steadily growing through a series of strategic acquisitions that enabled the company to offer complete roofing systems in both the residential and commercial markets. GAFMC purchased Cobra Ventilation Products, a maker of premier attic ventilation products, in 1992; International Permalite, a manufacturer of low thermal roofing insulation products, in 1994; U.S. Intec, a producer of an extensive line of commercial roofing products, in 1995; and Leatherback Industries, a supplier of roofing felts and construction papers for the residential market, in 1997.

Continuing to maintain its top position in the U.S. roofing materials industry, GAFMC's sales grew to more than $850 million by 1996, a more than 50 percent increase over the $559 million of 1993.

In March 1996 GAF sold the sole radio station owned by GAF Broadcasting--by that time known as WAXQ&mdashø the Entercorn radio group for $90 million. The more significant divestment, however, came in January of the following year when GAF Corporation's remaining stake in ISP was distributed to GAF shareholders, severing the last direct connection between GAF and ISP, although Heyman remained ISP chairman. By this time, ISP had been turned around through a renewed commitment to research and development and through an aggressive program of overseas expansion, including the opening of new plants in Europe in 1993 and in the Far East in 1995. Revenues surpassed $700 million for the first time in 1996, while operating income increased 12 consecutive quarters on a year-to-year basis starting in 1994.

GAF Corporation neared the new millennium exclusively as a roofing supplies company but as the leader in its sole industry. Although representing only a fraction of the rich history of GAF Corporation, GAF Materials Corporation was the top company in its field, was growing rapidly, and continued to proudly carry the GAF name.

Principal Subsidiaries: G-I Holdings Inc.; G Industries Corporation; GAF Building Materials Corporation; Building Materials Corporation of America.

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Exhibit D

Remedial Investigation Report
LCP Chemicals, Inc. Superfund Site
Linden, New Jersey
Volume I of V
Report Text

Prepared for
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July 2013

Project Number: 137005

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July 2013

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R2-0002967

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Executive Summary

The LCP Chemicals, Inc. Superfund Site (LCP site) Remedial Investigation (RI) is reported herein. The RI field investigation has been performed in two phases under the regulatory and technical oversight of the USEPA, with a further adjunct investigation of two off-site ditches located adjacent to the site. This report includes a comprehensive characterization of the nature and extent of contamination on the site in addition to assessments of risk to human health and the environment.

Site History

The LCP site is a former chemical manufacturing plant located on an approximate 26 acre property. The site was developed in the early 1950s for the production of chlorine by the brine cell process (mercury cathode carbon anode) also known as the chlor-alkali process. Chlorine manufacturing operations commenced in 1955 and continued until the plant was shut down in 1985. Related operations, including a hydrogen gas processing plant and sodium hypochlorite manufacturing area were also located on the site. While the plant was initially developed and operated by GAF beginning in 1955, the facility was sold to LCP in 1972 and was expanded and operated by LCP until 1985. Activities continued on site (by LCP and others) until 2000.

Hanlin Group, Inc., d.b.a. LCP, filed a petition under Chapter 11 of the bankruptcy code in 1991 and liquidated all of its assets before April 1994 using the proceeds to pay creditors including the USEPA. The Linden, New Jersey property was abandoned by Hanlin Group pursuant to an order of the Bankruptcy court and ownership reverted back from the bankruptcy estate. Title to the property is currently listed as LCP-Chemicals New Jersey, a d.b.a. for Hanlin. Hanlin is a defunct corporate entity. The facility has remained abandoned since 2000.

The site was placed onto the National Priority List (NPL) in 1998. A voluntary Administrative Order was entered into by the USEPA and ISP-ESI in 1999 to perform a Remedial Investigation and Feasibility Study (RI/FS). ISP Environmental Services Inc. (ISP-ESI) is currently the only potentially responsible party, among several, that has cooperated with USEPA to address the site.

The LCP site has a complex history of industrial ownership. The north-central and eastern portions of the property were owned and developed by various companies preceding GAF dating back to the 1880s. Other portions of the property were previously owned by E.I. duPont de Nemours and Central Railroad of New Jersey (now Conrail).

The entire area of the LCP site and nearly all of the surrounding area was historically tidal wetlands. It was necessary to raise the elevation prior to the historic development of these areas for industrial and other uses through the placement of anthropogenic fill. The filling of the property occurred during the prior ownership of the property, before the development of the LCP site in 1955.

The site has been zoned for "heavy industrial use" and continues as such as do the surrounding properties. It is anticipated that the upland portion of the site could possibly be re developed into another industrial use, such as warehousing, transportation or electric power generation.

Contamination Sources

The RI results are summarized by the finding of the widespread presence of mercury in various environmental media as a result of manufacturing activities at the LCP site. Other contaminants potentially related to chlorine production are also found, including hexachlorobenzene (HCB), polychlorinated naphthalenes (PCNs), and polychlorinated dibenzo furans (PCDFs). Polychlorinated biphenyls (PCBs) are also a site-related constituent due their potential presence in electrical equipment on the site. Each of these other site-related constituents is present at levels much less than those of mercury. These other site-related contaminants are co-located with mercury; however the frequency and magnitude of exceedances of soil remediation standards is, respectively, less than that of mercury.

Contamination is also present as a result of the prior placement of anthropogenic fill materials. Contaminants that are ubiquitous in fill materials include metals/metalloids (e.g., lead, chromium, and arsenic), and polycyclic aromatic hydrocarbons (PAHs) as a result of the common practice of using combustion residues (e.g., coal ash and slag) as fill. Other contaminants in the anthropogenic fill are consistent with sources of industrial fill from neighboring properties (e.g., duPont, GAF) and include arsenic and chlorobenzenes. Other various chemicals, including dioxins, are also found from regional sources such as air deposition and sediment transport.

Contamination Conditions

The surficial fill at the LCP site is impacted primarily with mercury which is widely distributed throughout the site. This contamination includes some visual observations of elemental mercury in areas surrounding the main production buildings. However, the horizontal and vertical migration of mercury and other site-related constituents is relatively limited and the underlying soils contain concentrations that are lower than those in the overlying fill.

Groundwater contamination at the site results from the dissolution of the various contaminants from site soils (both LCP related and fill related). Groundwater contamination, however, shows minimal migration either horizontally or laterally and is not moving off site to any significant extent. In addition, groundwater at the site is non-potable as the result of naturally occurring saline conditions. Since the groundwater is saline, alternative groundwater quality criteria (AGWQC) are relevant at the site, and site-specific AGWQC have been developed.

Sediments and low marsh soils in South Branch Creek (an on-site, man-made tidal ditch) are contaminated with mercury and other constituents, especially in the “upstream” areas. The contamination decreases with distance from the manufacturing area of the site and is essentially at background levels where South Branch Creek meets the Arthur Kill. Similar contaminated sediment conditions are observed in the Northern Off-Site Ditch Sediments, albeit at lower concentrations than South Branch Creek. The sediment contamination in South Branch Creek and the Northern Off-Site Ditch do not appear to be due to ongoing sources. Biological specimens (fish and crabs) collected in South Branch Creek contain elevated concentrations of mercury and other constituents compared with those collected in a nearby area.

The Human Health Risk Assessment (HHRA) indicated that exposure to soil and soil vapor by future commercial/industrial workers, site-specific workers, and construction/utility workers may result in adverse non-cancer effects; exposure to soil by future commercial/industrial workers may also result in adverse cancer effects. Dermal contact with groundwater by construction/utility workers has the potential to result in adverse non-cancer effects. Potential non-cancer hazards in soil and soil vapor were driven by mercury; potential non-cancer hazards in groundwater were driven by furans and manganese. No unacceptable cancer or non-cancer risks were identified for current/future trespassers exposed to sediment/bank soil in South Branch Creek. Hypothetical use of groundwater for potable purposes was also evaluated to support remedial decision-making and risk management; the HHRA indicated future potable use of groundwater by commercial/industrial workers may result in adverse cancer and non-cancer effects.

The Baseline Ecological Risk Assessment (BERA) indicated that contaminants in South Branch Creek sediment, primarily arsenic, barium, and mercury, have the potential to result in adverse ecological effects to benthic macroinvertebrates and sediment-probing birds. Potential ecological risks were also identified for terrestrial mammals (insectivores) and birds (invertivores and, to a lesser extent, carnivores) potentially exposed to contaminants in upland soil, driven primarily by mercury and hexachlorobenzene. However, the former facility offers limited ecological habitat for these receptors as the majority of the Site is paved or occupied by structures.

Section 1

Introduction

This report presents the findings of a multi-phased Remedial Investigation (RI) performed at the LCP Chemicals, Inc. Superfund Site located in Linden, New Jersey. The initial phase (Phase I) of the RI was performed in 2001-2002 and was reported in the document titled, "Site Characterization Summary Report, LCP Chemicals Superfund Site, Linden, New Jersey", (Brown and Caldwell, August 2002). The Phase II RI field investigation was performed during 2006-2007 and the data was reported in the document titled, "Phase II Site Characterization Summary Report, LCP Chemicals Superfund Site, Linden, New Jersey, (Brown and Caldwell, September 2007). In addition an adjunct investigation to the RI was performed in 2011 on the two off-site ditches, in response to EPA comments on the draft RI Report (Brown and Caldwell, September 2008). The RI Report, presented herein, provides a comprehensive presentation and analysis of the RI data.

1.1 Authority

The site was placed onto the National Priority List (NPL) in 1998. On May 13, 1999, Administrative Order No. II CERCLA 02 99 2015 (hereinafter referred to as the Order) was entered into voluntarily by the United States Environmental Protection Agency (USEPA) and ISP Environmental Services Inc. (ISP-ESI). ISP-ESI is currently the only potentially responsible party, among several, that has cooperated with USEPA to address the site. The stated purpose of the Order was to:

"(a)… conduct a remedial investigation ("RI") to determine the nature and extent of contamination and any threat to the public health, welfare, or the environment caused by the release or threatened release of hazardous substances, pollutants or contaminants at or from the Site; (b) to determine and evaluate alternatives, through the conduct of a feasibility study ("FS"), to remediate said release or threatened release of hazardous substances, pollutants, or contaminants; (c) to provide for the reimbursement to EPA of response and oversight costs incurred by EPA with respect to the Site; and (d) to provide for reimbursement to EPA of response costs incurred by EPA at the Site prior to the effective date of this Consent Order."

In accordance with the provisions of Section VII.25.H of the Order, the RI Report is hereby submitted. The RI report provides an analysis of the horizontal and vertical extent of mercury and other site constituents at the site in the various site media. The RI field investigation and reporting were performed by Brown and Caldwell from 2001 through 2008 under contract to and on behalf of ISP-ESI. The scope of the initial phase of the RI field investigation was performed in accordance with the USEPA-approved Work Plan documents described in Section 1.4.1. The technical objectives and scope of the Phase II RI field investigation was performed in accordance with the USEPA-approved Work Plan documents described in Section 1.4.2.

Baseline Human Health Risk Assessment (BHHRA) and Baseline Ecological Risk Assessment (BERA) have been performed in accordance with a pending amendment to the Administrative Order Amendment. The BHHRA and BERA were performed by Geosyntec Consultants Inc. under contract to ISP-ESI and are summarized, herein. The full text of BHHRA and BERA reports are provided as Appendices P and Q, respectively.

1.2 Site Description

The LCP Chemicals, Inc. Superfund Site (hereinafter referred to as the LCP site) is located in the Tremley Point section of the City of Linden, Union County, New Jersey. The site is located along the western shore of the Arthur Kill and east of the New Jersey Turnpike as shown on Figures 1-1 and 1-2. It is accessed from the Road to Grasselli, which is reached from Linden via South Wood Avenue and Tremley Point Road. The coordinates of the approximate center of the site are Latitude 40.60832º and Longitude -74.21163º.

The site was formerly an industrial complex with chemical manufacturing operations. A mercury-cell, chlorine production (chlor-alkali) facility was operated at the site from 1955, until cessation of manufacturing operations in 1985, and included a mercury-cell chlorine process area, hydrogen gas processing plant, and sodium hypochlorite manufacturing area, as shown on Figure 1-3. The site was also used as a terminal for products produced at other facilities and various other industrial operations. In addition, a variety of tenants operated on site until the site was closed in August 1994.

The area surrounding the LCP site was historically developed for heavy industrial use, much of which is currently inactive and/or decommissioned. Primary current, active land use in the area is bulk storage and transport of petroleum products and aggregates.

Tidal wetlands are known to have existed historically in the area of the site. The placement of anthropogenic fill to raise the grade for industrial development is known to have occurred starting in the 1880s along the margins of the Arthur Kill.

1.3 Site History

1.3.1 Property Ownership

The real property parcels on which the LCP Chemicals, Inc. Superfund Site is located include City of Linden Block No. 587, Lots No. 3.01, 3.02, and 3.03. The land has a long and complex history of industrial use and property ownership. This ownership history has been researched by Keller & Kirkpatrick (2008) based on a detailed evaluation and reconstruction of the areas represented by various historic deeds that are available from public records from approximately 1909 to the present. Information regarding various property transfers and easements is presented on a series of maps by Keller & Kirkpatrick (Appendix A) and is summarized on Table 1-1. A description of the historic land ownership and easements is described on the basis of this research and on other available information.

1.3.1.1 Historic Land Ownership

The north central portion of the LCP site had a long history of industrial ownership starting in about 1880 with the Standard Chemical Works that was purchased by the Grasselli Chemical Company in 1889. Around 1924, the Grasselli Dyestuff Corporation, which is reported to have been a joint venture of Grasselli Chemical and Bayer AG, was incorporated under the laws of the State of Delaware.

The Grasselli Chemical Company transferred a number of large parcels to the Grasselli Dyestuff Company on October 20, 1928 which included, in part, the northern portion of what became the LCP property. Parallel property transfer records indicate duPont purchased the property in 1928. The property transfer record indicates this same area was transferred by Grasselli Chemical Company to E.I. duPont de Nemours and Company (duPont) on November 30, 1928. In addition, a strip of property extending to the Arthur Kill east of the tracks was also transferred to Grasselli Dyestuff Company that would later be used for relocation of South Branch Creek.

Grasselli Dyestuff Corporation changed its name to General Aniline Works, Inc. on February 27, 1929. The company then changed its name to General Aniline & Film Corporation on October 30, 1939 and merged into American I.G. Chemical Corporation on October 31, 1939[1].

In 1942, the United States Justice Department seized American I.G. Chemical Corporation as a war asset. While under government control, the General Aniline & Film Corporation completed construction of a chlor-alkali (chlorine manufacturing) plant on the LCP site in 1955. In 1965 the U.S. Government sold the ownership of General Aniline & Film Corporation in a public stock offering. General Aniline & Film Corporation changed its name to GAF Corporation on April 24, 1968.

Other parcels in what became the LCP property were acquired separately. The central portion of the LCP property located west of the railroad tracks was owned by E.I. duPont de Nemours and Company prior to 1949 and transferred to General Aniline & Film Company in 1949. The southern portion of the LCP property located west of the railroad tracks was transferred from Central Railroad Company of New Jersey to General Aniline & Film Company in 1958. A narrow strip of land along what is now the current southern property line and extending to the extreme eastern tip was transferred from Central Railroad Company of New Jersey to General Aniline & Film Company in 1967.

GAF Corporation sold the LCP Site which included the chlor-alkali facility to Linden Chlorine Products, Inc. of Edison, New Jersey on August 24, 1972. LCP Chemicals and Plastics, Inc. conveyed its property to LCP Chemicals-New Jersey, Inc. on December 14, 1979. At some point, the company became known as LCP Chemicals, Inc., a division of the Hanlin Group, Inc.

1.3.1.2 Easements

Numerous easements have been established at the LCP site. These easements include various rights of way for physical access by road and rail to the LCP site, use of utility poles and other utilities, use of the flume and outfall ditch for wastewater drainage, easements for numerous underground and overhead utility lines not specifically related to the LCP site including a historic sanitary sewer trunk line; gas and petroleum transmission lines; water lines; electric lines, access to leaseholds within the LCP site property; and access to other neighboring properties. These easements are listed on Table 1-1.

1.3.1.3 Site Operation

GAF began the chlorine operation at the LCP site in 1955. By 1956, the core of the buildings required for the chlorine productions were present, including Buildings 220 and 230. GAF had stopped operation of the chlor-alkali manufacturing facility in 1971. Linden Chlorine Products, Inc., which was founded in 1972, purchased the site from GAF and subsequently resumed operation of the plant. Another mercury cell building (Building 240) and other site buildings were added by LCP in the early 1970s.

As of 1975, Linden Chlorine Products, Inc. reported that it owned no other manufacturing facilities and that only three products were produced – chlorine, sodium hydroxide, and hydrogen. By the early 1980’s, the company had acquired additional chlor-alkali manufacturing facilities, including sites in Syracuse, New York, Moundsville, West Virginia, and Brunswick, Georgia.

Portions of the LCP site were leased to other companies for the operation of other related manufacturing operations at the site. In 1957, part of the property to the west, was leased to Union Carbide Corporation (UCC) to be used as a hydrogen plant utilizing the by-products of the chlorine plant and is known as the Linden Division hydrogen plant. UCC operated its plant through 1990. Kuehne Chemicals, Inc. leased the northern portion of the property in 1972 and opened a sodium hypochlorite manufacturing plant, which also distributed and sold chlorine.

[1] The merger into American I.G. Chemical Corporation in 1939 is reported in the deed research by Keller & Kirkpatrick. Other records suggest that ownership by American I.G. Chemical Corporation may have occurred in approximately 1928 or 1929.

The ownership of the Linden Chlorine Products, Inc. facility became LCP Chemicals-New Jersey, Inc., a subsidiary of Linden Chemicals & Plastics, Inc. The chlor-alkali manufacturing operations had ceased by 1985 and the facility was used as a terminal for products produced at other locations.

Hanlin Group, Inc., d.b.a. LCP, filed a petition under Chapter 11 of the bankruptcy code in 1991 and liquidated all of its assets before April 1994 using the proceeds to pay creditors including the USEPA. The Linden, New Jersey property was abandoned by Hanlin Group pursuant to an order of the Bankruptcy court and ownership reverted back from the bankruptcy estate. Title to the property is currently is listed as LCP-Chemicals New Jersey, a d.b.a. name for Hanlin. Hanlin was formerly incorporated in New Jersey but is now a defunct corporate entity.

In August 1994, the EPA conducted a site visit and confirmed that the chlorine process buildings were decommissioned, the facility was no longer functional and that the site was vacated by LCP employees. Active Water Jet Inc., a pipe cleaning company, who was a tenant at the site since about the early 1990s, remained onsite until 2000. The facility has remained abandoned ever since.

1.3.2 Operations and Development

The text in this section has been adapted from the document titled "Work Plan, Remedial Investigation and Feasibility Study" (URS, October 6, 2000) and updated with information that has been obtained from other available sources. Much of the historic information presented, herein, is compiled from documents dating back to 1975 and earlier. Within these documents there are some contradictions concerning the past operations of the site. This problem is compounded by the fact that much of LCP Chemicals, Inc.'s records were lost or destroyed sometime in the 1980s (Eder, September 1993).

At the time of LCP Chemicals, Inc.'s mercury cell chlorine production, there were three main operating centers at the site; the mercury cell chlorine process area, the hydrogen gas processing plant, and the sodium hypochlorite manufacturing area. Materials needed for processing were shipped in by barge, rail, or by truck. Storage and distribution of chlorine and its related products (including methylene chloride and potassium hydroxide) occurred on this site throughout its history. The manufacturing operations were subject to periodic shutdowns due to changes in market demands for chlorine production. The processes by which the chlorine and its by-products were created are described in the section below.

1.3.2.1 Mercury Cell Chlorine Process Area

The mercury cell was an industrial system that split common salt molecules (NaCl) to produce chlorine gas. A typical mercury cell process used electrolysis to split the salt solution. An electric current was passed through the salt solution (brine) between a graphite anode and a mercury cathode (Figure 1-4) to produce chlorine gas and sodium. The sodium dissolved into the mercury and the sodium-mercury mixture was made to react with water to produce sodium hydroxide and hydrogen gas. All of the material from this process, including the spent brine, hydrogen gas and sodium hydroxide, contained residual amounts of mercury. The mercury was separated from the resulting chlorine and hydrogen gas and sodium hydroxide which were packaged for sale for additional processing and/or for distribution.

The raw materials used in the chlorine production process were salt, water, mercury, and electric power. Documentation of LCP Chemicals, Inc.'s procedure for the handling and storage of chemicals is not available. Rock salt or evaporated salt, which was utilized later, was transported to the site by rail. It was stored in salt silos located by Building 233 (Figure 1-3) and fed to the adjacent saturators to create brine. The brine was treated and filtered in a brine treatment tank in Building 233. To treat the brine, sodium hydroxide, sodium carbonate, and barium chloride were added to precipitate impurities in the solution, such as calcium carbonate, sulfates, and hydroxides. The residual material is known as brine purification mud or "brine sludge". In the mid 1960s, a surface impoundment, the brine sludge lagoon, was constructed and used to dispose the brine sludge and process wastewater. The sludge was mixed with brine and the resulting slurry was pumped to the brine sludge lagoon through overhead pipes. The supernatant, or liquid content of the brine sludge lagoon, was pumped back to the brine purification tank for recycling and for redistribution either to the mercury cells or for the slurry usage. Documentation of the disposal practices for the brine sludge before the construction of the sludge lagoon is not available.

After pre-treatment of the brine, it was piped to the mercury cells in Building 230 and Building 240 to produce gaseous chlorine and a mercury sodium mixture through electrolysis. Once the chlorine was cooled, dried (i.e., water vapor removal) with sulfuric acid, and liquefied in Building 233, it was stored in 100 ton vessels. The used brine was recycled to the treatment tank in Building 233 for re saturation and to repeat the process.

The mercury-sodium mixture was then piped to denuders, or strippers, where it was hydrolyzed to form elemental mercury, a sodium hydroxide solution and gaseous hydrogen. The recovered mercury was returned to the mercury cells. The sodium-hydroxide solution was filtered and stored in above ground storage tanks at the northeast corner of the facility. The hydrogen gas was also filtered by way of a commercial "Purasiv" unit south of Building 231. From there it was piped to the hydrogen facility where it was packaged and distributed by Union Carbide (Linde Division). Occasionally, the hydrogen gas was mixed with water and chlorine to form hydrochloric acid in both gaseous and liquid form. The hydrochloric acid was then stored in tanks near Building 231. In 1985, LCP Chemicals stopped the mercury cell process, thus brine sludge production was also stopped.

Between 1985 and 1994, the site was used as a transfer terminal for products made at other Hanlin Group Facilities. The Hanlin products were shipped to the site via rail or truck and stored in above ground storage tanks. From there they were repackaged and distributed. The products were potassium hydroxide, sodium hydroxide, hydrochloric acid and methylene chloride. Aerial photographs of the facility during full operation in 1966-67 (Building 240 not constructed yet) and shortly after shut down of the mercury cell process are shown on Figures 1-5 and 1-6, respectively.

1.3.2.2 Linde Division Hydrogen Plant

The hydrogen plant was operated by the Linde Division unit of Union Carbide Corporation (Linde) which occupied a 2.1-acre leasehold on the western portion of the site (Figure 1-3) interconnected to the mercury cell process area. The Linde Division hydrogen plant started operation in 1957 and ceased operation in 1990. Hydrogen was supplied from the mercury cells to the plant via overhead pipes. The gas was purified by UCC to remove additional residual mercury (reportedly, at least five pounds of mercury was removed from the gas stream by Linde daily), stored, compressed, and shipped by trailer. Union Carbide, in their 104(e) response claims that one disposal method for the Linde waste mercury was to give it to employees for resale. In 1980, the hydrogen plant stopped using the hydrogen from the chlorine plant, and began to package liquid cryogenic hydrogen that was shipped in from outside sources.

In 1988, in preparation for a new tenant, UCC had the building interior and the hydrogen compressors decontaminated for mercury (IT, April 22, 1988). IT reportedly recovered 30 pounds of free mercury from one compressor and its associated piping.

In May 1990, the Linde Division plant ceased operations after the UCC lease with LCP expired. This triggered the NJDEP's Environmental Cleanup Responsibility Act (ECRA, now known as ISRA). Due to several areas of concern unrelated to the chlorine manufacturing process (i.e., former underground storage tanks, sumps, septic tanks, etc.), ISRA required that a soil and groundwater investigation be conducted within the boundaries of the site. The required investigation and its cleanup took place in the early 1990s. The NJDEP granted a No Further Action (NFA) declaration for the hydrogen facility on June 20, 1995 for soils only. To our knowledge, Praxair (successor to UCC) has had engineering controls on the leasehold.

The Linde Division facility was last used in October 1994 by Liquid Carbonic Corporation. Liquid Carbonic Corporation was later purchased by Praxair, Inc. Liquid Carbonic rented the Linde Division site from LCP Chemicals, Inc., and used it for office space and as a parking area for truck trailers.

1.3.2.3 Hypochlorite Facility

Kuehne Chemical, Inc., leased Lot Nos. 3.02, 3.03 and the northern part of Lot 3.01 from LCP Chemicals, Inc. and started a sodium hypochlorite manufacturing process. The processing area was located to the north of Building 220 and between Avenue C and D and consisted of above ground storage tanks, loading areas and support buildings (Figure 1-3). The manufacturing plant received its raw materials, chlorine and sodium hydroxide, from the LCP chlorine plant via overhead pipes. The raw material were utilized by Kuehne to produce sodium hypochlorite (bleach). Chlorine, sodium hydroxide, hydrochloric acid, and sodium hypochlorite were also stored and distributed by Kuehne. Kuehne Chemical Inc. had vacated the site by February 1981. It is likely Kuehne mercury waste was disposed of along with the LCP mercury waste.

1.3.2.4 Other Operators

Conrail (successor to Central Railroad of New Jersey) constructed and operated a railroad line and railroad yard across the property as described in Section 2.1.1 and as shown on Figure 2-8.

Active Water Jet operated a pipe and tank washing operation on the property from 1990 until 2000. Active Water Jet cleaned, with water blasting, contaminated tanks, filters, pipes, condensers and similar items. Its offices were located in building 220.

Caleb Brett leased a portion of the property from 1988 to 1995; they are known to have stored petroleum crude oil, No. 6 fuel oil, kerosene, asphalt products, pot ash, caustic soda, alcohol, and ketones at the site.

Microcell Technologies leased building 231 from 1987 until 2000 and operated a pilot plant that produced small glass spheres.

1.4 RI Site Investigation

The work plan documents and the technical objectives for each of the RI field investigations are described below.

1.4.1 Phase I RI

Phase I RI Work Plan Documents

The Phase I RI was performed during 2001 and 2002 in accordance with the following USEPA-approved documents:

1. "Work Plan, Remedial Investigation and Feasibility Study" (URS, October 6, 2000).
2. "Final Sampling and Analysis Plan, Field Operations Plan, Part I, Draft Sampling and Analysis Plan" (URS, April 12, 2001), hereinafter referred to as the FOP.
3. "Quality Assurance Project Plan, Field Operations Plan, Part II, Draft Sampling and Analysis Plan" (URS, February 12, 2001), hereinafter referred to as the QAPP.
4. "Addendum No. 1, Field Operations Plan for the LCP Chemicals, Inc. Superfund Site, Cased Deep Borings," (Brown and Caldwell, October 12, 2001).
5. "Addendum No. 2, Field Operations Plan for the LCP Chemicals, Inc. Superfund Site, Subsurface Utility Clearance," (Brown and Caldwell, November, 2001).
6. "Addendum No. 3, Field Operations Plan for the LCP Chemicals, Inc. Superfund Site, Sampling Beneath Buildings 230 and 240" (Brown and Caldwell, March 2002).

Agency approval of these Phase I RI Work Plan documents was provided in letters from USEPA in 2001 and 2002.

Phase I RI Objectives

The objectives of the Phase I RI were stated in Section 2 of the "Final Sampling and Analysis Plan, Field Operations Plan, Part I, Draft Sampling and Analysis Plan" (URS, April 12, 2001):

- Determine the nature and extent of contamination in the soil, groundwater, surface water, and sediment.
- Evaluate stratigraphy on a site-wide basis - confirm the distribution of the Tidal Marsh Deposit and evaluate its effectiveness as a confining layer.
- Define the hydrogeology on a site-wide basis - confirm groundwater gradients, flow directions, and aquifer properties (e.g., hydraulic conductivity, transmissivity, etc.) to predict the direction and flow rate of groundwater contaminant migration.
- Evaluate tidal effects on groundwater and groundwater flow direction.
- Evaluate the potential ecological resources of, and impacts to, South Branch Creek.
- Characterize anthropogenic fill at the site.
- Develop a conceptual site model.
- Determine risks posed to human health and environment.

The results of the Phase I RI field investigation were presented in the document titled, "Site Characterization Summary Report (SCSR), LCP Chemicals Superfund Site, Linden, New Jersey", (Brown and Caldwell, August 2002).

1.4.2 Phase II RI

Phase II RI Work Plan Documents

The Phase II RI was performed from August 2006 through June 2007 in accordance with the following 14 USEPA-approved documents:

1. "Work Plan, Remedial Investigation and Feasibility Study" (URS, October 6, 2000).
2. "Final Sampling and Analysis Plan, Field Operations Plan, Part I, Draft Sampling and Analysis Plan" (URS, April 12, 2001), hereinafter referred to as the FOP.
3. "Quality Assurance Project Plan, Field Operations Plan, Part II, Draft Sampling and Analysis Plan" (URS, February 12, 2001), hereinafter referred to as the QAPP.
4. "Addendum No. 1 (Soil and Groundwater) Work Plan: Phase II Remedial Investigation, LCP Chemicals, Inc. Superfund Site", (Brown and Caldwell, July 2004, Revised April 2006, Revised October 2006).
5. "Addendum No. 2 (South Branch Creek & Ecological Issues) Work Plan: Phase II Remedial Investigation, LCP Chemicals, Inc. Superfund Site", (Brown and Caldwell, July 2004, Revised August 2006, Revised October 2006).
6. "Addendum No. 1, Field Operations Plan for the LCP Chemicals, Inc. Superfund Site, Cased Deep Borings," (Brown and Caldwell, October 12, 2001).
7. "Addendum No. 2, Field Operations Plan for the LCP Chemicals, Inc. Superfund Site, Subsurface Utility Clearance," (Brown and Caldwell, November, 2001).
8. "Addendum No. 3, Field Operations Plan for the LCP Chemicals, Inc. Superfund Site, Sampling Beneath Buildings 230 and 240" (Brown and Caldwell, March 2002).

9. "Addendum No. 4, Field Operations Plan, LCP Chemicals, Inc. Superfund Site (Bedrock Monitoring Wells, Soil Vapor Testing, Groundwater Sampling)", (Brown and Caldwell, April 2006, Revised October 2006).
10. "Addendum No. 5, Field Operations Plan for the LCP Chemicals, Inc. Superfund Site, Ecological Sampling", (Brown and Caldwell, August 2006, Revised October 2006).
11. "QAPP Addendum for South Branch Creek Sampling," (Brown and Caldwell, August 2006, Revised October 2006).
12. "Supplemental Work Plan: Sediment Toxicity Testing (South Branch Creek), Phase II Remedial Investigation LCP Chemicals, Inc. Superfund Site," (Brown and Caldwell, September 2006, Revised October 2006).
13. "Interim Ecological Risk Assessment Problem Formulation," (Brown and Caldwell, Revised October 2006).
14. "Health and Safety Plan For Phase II Remedial Investigation at the LCP Chemicals, Inc. Superfund Site," (Brown and Caldwell, September 2006).

Agency approval of these Phase II RI Work Plan documents was provided in the following:

- Letter from Ms. Carole Petersen of USEPA dated September 13, 2006 referenced: "Conditional Approvals for Addendum No. 2 (South Branch Creek and Ecological Issues) Work Plan: Phase II Remedial Investigation, LCP Chemicals, Inc. Superfund Site (Revised July 2006); and Addendum No. 5 Field Operations Plan LCP Chemicals, Inc. Superfund Site (Ecological Sampling) (August 2006)."
- Letter from Ms. Carole Petersen of USEPA dated October 5, 2006 referenced: "Conditional Approvals for Addendum No. 1 (Soil and Groundwater) Work Plan: Phase II Remedial Investigation, LCP Chemicals, Inc. Superfund Site (April 2006) and Addendum No. 4 Field Operations Plan, LCP Chemicals Inc. Superfund Site (Bedrock Monitoring Wells, Soil Vapor Testing, Groundwater Sampling) (April 2006)."
- Submittal of revised Phase II Work Plan documents to USEPA by October 13, 2006 in accordance with the conditions set forth in the conditional approval letters.

Phase II RI Objectives

The Phase II RI Work Plan included an approach and methodology to address the following technical objectives:

- Additional delineation of surficial and shallow soils in the western area of the site through the installation and testing of soil from a number of borings.
- Characterization of deep soils through the installation and testing of a number of borings to determine the vertical extent of contamination identified in the shallow soils.
- Characterization of soil quality within the glacial till beneath Building Nos. 230 and 240.
- Determination of the presence of methyl mercury in soil from a number of shallow and deep soil samples obtained in various areas of the site.
- Determination of the specific form of mercury in a number of surficial soil samples including mercuric (Hg+2), mercurous (Hg2+2), and methyl (CH3Hg+).
- Characterization of surficial soil quality near storage tanks remaining at the site that may have had potential releases to the environment.
- Determination of groundwater quality in the bedrock water-bearing zone.

- Additional characterization of groundwater quality in the overburden water-bearing zone through the collection of a second complete round of monitoring well samples, including the use of "ultra-clean" sample collection and handling techniques for mercury.
- Determination of the groundwater flow characteristics in the bedrock water-bearing zone.
- Additional characterization of groundwater flow conditions in the overburden water-bearing zone.
- Determination of the in-place hydraulic conductivity of the unconsolidated and consolidated geologic material screened by the newly installed monitoring wells.
- Determination of the presence of methyl mercury in groundwater from a number of overburden and bedrock groundwater samples obtained in various areas of the site.
- Characterization of soil vapor to address the potential vapor intrusion pathway to future building structures at the site.
- Current wetland delineation and jurisdictional determination.
- Additional delineation of selected constituents in sediment and surface water in South Branch Creek as well as in the confluence area of South Branch Creek and Arthur Kill to address ecological concerns.
- Evaluation of the bioavailability of mercury in the surface water and sediment within South Branch Creek. This includes a determination of the ratio of methyl mercury to total mercury.
- Determination of the influence of mercury speciation and sediment chemistry on bioavailability to aquatic organisms.
- Utilization of a Reference Channel for the purpose of differentiating certain chemical constituents with respect to the background conditions when performing environmental characterization and analysis.2
- Estimation of biota sediment accumulation factors (BSAFs) from sediment to crabs and fish.
- Collection of site-specific information to support the Baseline Ecological Risk Assessment, including a biologic habitat assessment and the collection of tissue residue in selected aquatic biota in South Branch Creek and the confluence area of South Branch Creek and Arthur Kill.
- Evaluation of sediment toxicity.

1.4.3 Off-Site Ditch Investigation

Off-Site Ditch Work Plan Documents

The off-site ditch investigation phase of the RI was performed from July 22, 2011 to July 28, 2011 in accordance with the following two USEPA-approved documents:

- "Revised Scope of Work - Characterization of Off-Site Ditches, LCP, Chemicals Inc. Superfund Site", (Brown and Caldwell, May 14, 2010).
- "Quality Assurance Project Plan, LCP Chemicals, Inc. Superfund Site, Linden, New Jersey", (Brown and Caldwell, May 2010).

Off-Site Ditch Work Plan Objectives

The Off-Site Ditch Scope of Work included an approach and methodology to address the following technical objectives:

[2] The Phase II RIWP documents, dated October 2006, included tasks for the selection and collection of samples from a reference stream. An e-mail message dated August 18, 2006 from Mr. Jon Gorin of USEPA to ISP-ESI that stated " . . . after consulting with BTAG, we've determined that there is no need for a reference stream right now." The approved documents included identification and sampling of a reference stream. This work was therefore conducted in accordance with the approved documents without oversight by USEPA.

- To characterize the extent to which the Northern and Southern Off-Site ditches are tidally influenced.
- To characterize the extent to which the Northern and Southern Off-Site ditches may be impacted by site-related constituents.

1.5 Report Organization

The data presented in this RI Report includes the Phase I and II RI data and is intended to characterize current site conditions for each medium that was investigated. The environmental database (Appendix F) contains the complete laboratory analytical data from both the Phase I and Phase II RI field investigations.

The RI Report is organized as follows:

- Section 1 Introduction
- Section 2 Site Setting
- Section 3 RI Field Investigation Methods and Procedures
- Section 4 Data Management
- Section 5 Physical Characteristics
- Section 6 Nature and Extent of Contamination
- Section 7 Contaminant Fate-and-Transport
- Section 8 Baseline Risk Assessment Summary
- Section 9 Recommendations
- Section 10 References

Appendices to the RI Report are as follows:

- Appendix A Property Transfers
- Appendix B Field Operations Plan
- Appendix C Well Construction and Soil Boring Logs
- Appendix D Hydrogeologic Data
- Appendix E Wetland Delineation
- Appendix F Habitat Assessment Report
- Appendix G Representative Photographic Logs
- Appendix H Analytical Lab Deliverables (DVD)
- Appendix I Data Usability Reports
- Appendix J Tabular Summary of Analytical Data
- Appendix K Environmental Database (CD-ROM)
- Appendix L Sediment Toxicity Testing Report
- Appendix M Regional Studies
- Appendix N NJDEP Technical Regulations Checklist
- Appendix O Human Health Risk Assessment
- Appendix P Ecological Risk Assessment

Exhibit E

Remedial Investigation Report
LCP Chemicals, Inc. Superfund Site
Linden, New Jersey
Volume II of V
Appendices A through G

Prepared for

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July 2013

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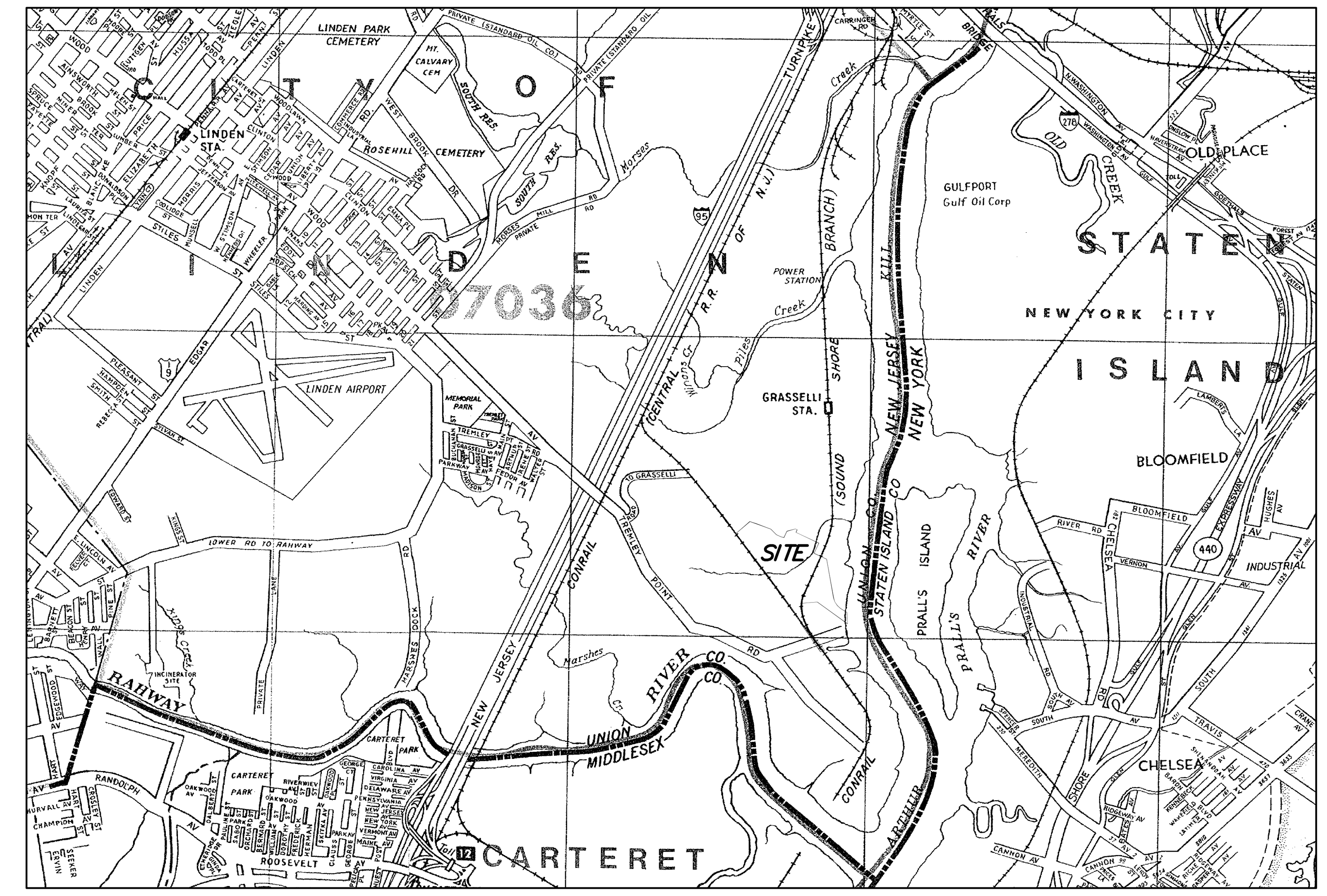
R2-0003603

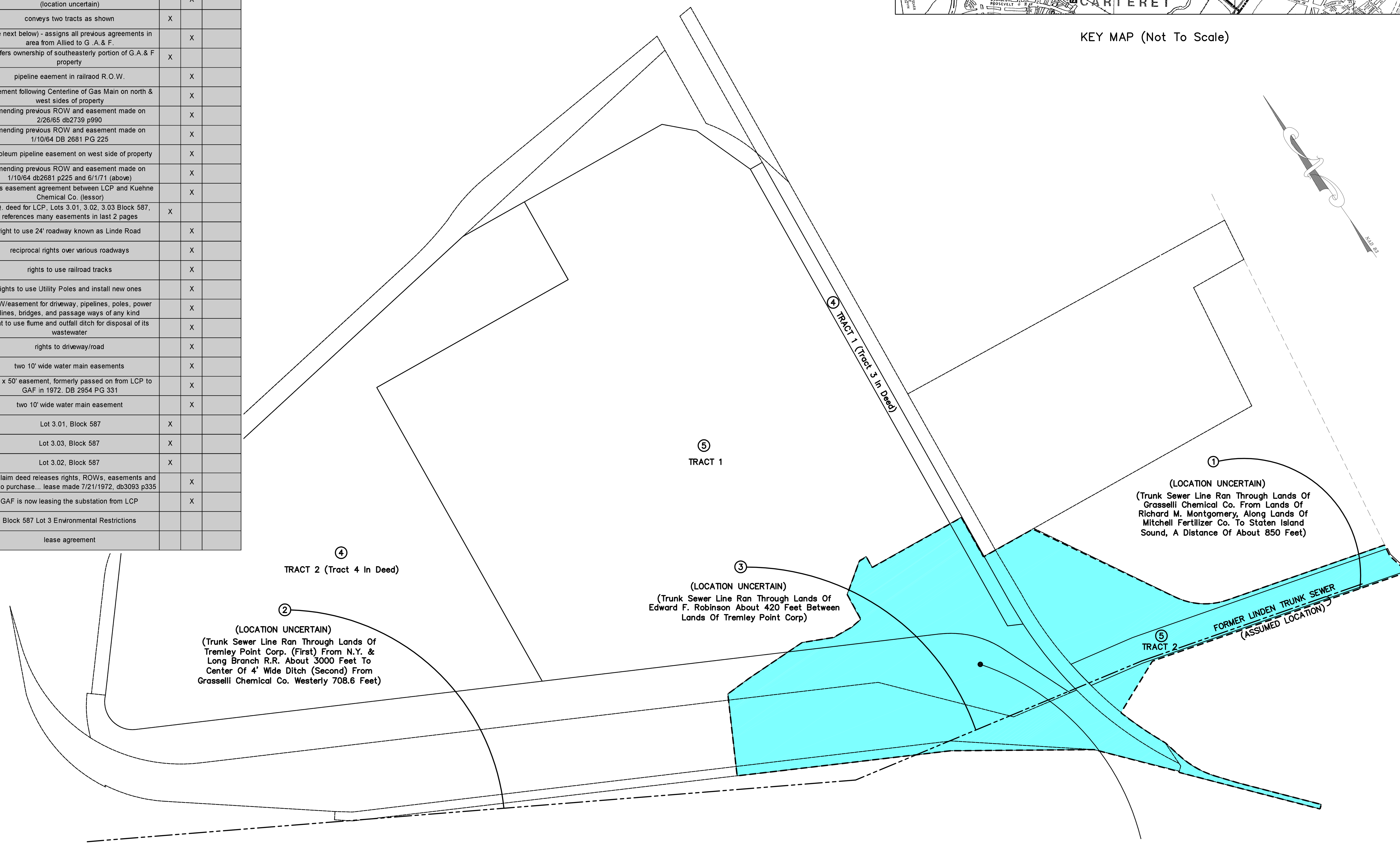
Appendix A: Property Transfers

TABLE OF DOCUMENTS SUPPLIED

No.	Date	Book	Page	Grantee	Grantor	Description	Prop-erty	Ease-ment	
1	7/27/1909	533	233	Borough of Linden	Grasselli Chemical Company	trunk sewer line through property to Staten Island Sound		X	
2	9/27/1909	533	589	Borough of Linden	Tremley Point Corporation	Trunk Sewer line through property		X	
3	2/28/1912	588	499	Borough of Linden	Edward F. Robinson	Trunk Sewer line through property		X	
4	10/20/1928	1165	576	Grasselli Dyestuff Corporation	The Grasselli Chemical Company	conveys two tracts as shown	X		
5	10/20/1928	1165	582	Grasselli Dyestuff Corporation	The Grasselli Chemical Company	conveys two tracts as shown	X		
6	11/30/1928	1162	250	E.I. duPont de Nemours and Company	The Grasselli Chemical Company	conveys lands not previously conveyed to Grasselli Dystuff Corp. (exceptions to Tract 5)	X		
7	10/31/1939	1391	302	General Aniline & Film Corporation	General Aniline & Film Corporation	consolidates and renames General Aniline Works And American I.G. Chemicals into General Aniline & Film	X		
8	5/5/1942	1458	210	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	additional acquisition from DuPont	X		
9	9/15/1949	1776	7	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	additional acquisition from DuPont	X		
10	7/7/1950	1847	79	duPont de Nemours	Central Railroad Company of New Jersey	irrevocable license to keep, maintain and use a private access road across railroad property		X	
11	4/18/1951	1898	168	Linden Roselle Sewerage Authority	Sinclair Refining Company	Block 587, Lots 5 & 21	X		
12	1/27/1958	2356	634	General Aniline & Film Corporation	Central Railroad Company of New Jersey	copy not included. believed to convey the railroad property highlighted	X		
13	7/9/1963	2648	319	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	Block 587, Lots 2.01, 2.02	X		
14	1/10/1964	2681	229	City of Linden	General Aniline & Film Corporation	easement for 36" Linden storm sewer		X	
15	11/19/1965	2771	858	Allied Chemical Corporation	Central Railroad Company of New Jersey	grants permission to maintain and use pipeline bridge and pipelines crossing railroad (location uncertain)		X	
16	11/19/1965	2771	862	Allied Chemical Corporation	Central Railroad Company of New Jersey	grants permission to use raodway crossing railroad (location uncertain)		X	
17	1/19/1967	2794	745	General Aniline & Film Corporation	The Central Railroad Company of New Jersey	conveys two tracts as shown	X		
18	5/15/1967	2802	839	General Aniline & Film Corporation	Allied Chemical Corporation	(see next below) - assigns all previous agreements in area from Allied to G .A.& F.		X	
19	5/15/1967	2802	536	General Aniline & Film Corporation	Allied Chemical Corporation	transfers ownership of southeasterly portion of G.A.& F property	X		
20	11/3/1967	2821	929	Union Carbide Corporation	General Aniline & Film Corporation	pipeline eaement in railraod R.O.W.		X	
21	8/20/1970	2909	697	Elizabethtown Gas Company	GAF Corporation	easement following Centerline of Gas Main on north & west sides of property		X	
22	2/24/1971	2917	226	Elizabethtown Water Company	GAF Corporation	amending previous ROW and easement made on 2/26/65 db2739 p990		X	
23	6/1/1971	2924	209	City of Linden	GAF Corporation	amending previous ROW and easement made on 1/10/64 DB 2681 PG 225		X	
24	8/12/1971	2928	677	Buckeye Pipe Line Company	GAF Corporation	petroleum pipeline easement on west side of property		X	
25	4/17/1972	2946	162	City of Linden	GAF Corporation	amending previous ROW and easement made on 1/10/64 db2681 p225 and 6/1/71 (above)		X	
26	7/21/1972	3093	335	Kuehne Chemical Company, Inc.	Linden Chlorine Products, Inc.	cross easement agreement between LCP and Kuehne Chemical Co. (lessor)		X	
27	8/24/1972	2954	273	Linden Chlorine Products	GAF Corporation	P.Q. deed for LCP, Lots 3.01, 3.02, 3.03 Block 587, references many easements in last 2 pages	X		
28	8/24/1972	2954	284	Linden Chlorine Products	GAF Corporation	right to use 24' roadway known as Linde Road		X	
29	8/24/1972	2954	296	Linden Chlorine Products	GAF Corporation	reciprocal rights over various roadways		X	
30	8/24/1972	2954	312	Linden Chlorine Products	GAF Corporation	rights to use railroad tracks		X	
31	8/24/1972	2954	323	Linden Chlorine Products	GAF Corporation	rights to use Utility Poles and install new ones		X	
32	8/24/1972	2954	331	GAF Corporation	Linden Chlorine Products	ROW/easement for driveway, pipelines, poles, power lines, bridges, and passage ways of any kind		X	
33	8/24/1972	2954	340	GAF Corporation	Linden Chlorine Products	right to use flume and outfall ditch for disposal of its wastewater		X	
34	1/17/1974	2995	280	Northvile Linden Terminal Corp.	GAF Corporation	rights to driveway/road		X	
35	5/8/1975	3033	986	Elizabethtown Water Company	Linden Chlorine Products	two 10' wide water main easements		X	
36	5/22/1975	3034	974	Northvile Linden Terminal Corp.	GAF Corporation	120' x 50' easement, formerly passed on from LCP to GAF in 1972. DB 2954 PG 331		X	
37	3/5/1976	3061	4	Elizabethtown Water Company	Linden Chlorine Products	two 10' wide water main easement		X	
38	12/14/1979	3207	82	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.01, Block 587	X		
39	12/14/1979	3207	93	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.03, Block 587	X		
40	12/14/1979	3207	97	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.02, Block 587	X		
41	8/11/1983	3331	219	Linden Chlorine Products	Kuehne Chemical Company	quit-claim deed releases rights, ROWs, easements and right to purchase... lease made 7/21/1972, db3093 p335		X	
42	9/17/1986	3499	97	GAF Corporation	Linden Chlorine Products	GAF is now leasing the substation from LCP		X	
43	9/23/1994	4228	125		Linden Chlorine Products	Block 587 Lot 3 Environmental Restrictions			
44	7/21/1972	3093	335	Kuehne Chemical Company, Inc.	Linden Chlorine Products	lease agreement			



KEY MAP (Not To Scale)



GRASSELLI DYESTUFF CORPORATION – PRIOR TO 1939 LCP SITE

REVISIONS 6 5 4 3 2 1

DATE: 4/23/08 SCALE: 1"=200' FLD. BK.:
PROJ.: 2001202 CHKD.: PAGE:

0 100 200 400 800

Keller & Kirkpatrick
301 Gibraltar Drive, Suite 2A, Morris Plains NJ 07950 973-377-8500
Certificate of Authorization #24GA28037400
CONSULTING ENGINEERS LAND SURVEYORS LANDSCAPE ARCHITECTS PLANNERS
WERNER A. WALL, Professional Land Surveyor, Lic. 37201
GEORGE F. JAMES, Professional Engineer, Lic. 22934

CHRONOLOGICAL DEED PLOTTING FOR
LCP Chemicals & Plastics, Inc.
TAX BLOCK 587
CITY OF LINDEN, UNION COUNTY, NEW JERSEY

SHEET No. 1 OF 6

R2-0003605

TABLE OF DOCUMENTS SUPPLIED

No.	Date	Book	Page	Grantee	Grantor	Description	Prop-erty	Ease-ment	
1	7/27/1909	533	233	Borough of Linden	Grasselli Chemical Company	trunk sewer line through property to Staten Island Sound		X	
2	9/27/1909	533	589	Borough of Linden	Tremley Point Corporation	Trunk Sewer line through property		X	
3	2/28/1912	588	499	Borough of Linden	Edward F. Robinson	Trunk Sewer line through property		X	
4	10/20/1928	1165	576	Grasselli Dyestuff Corporation	The Grasselli Chemical Company	conveys two tracts as shown	X		
5	10/20/1928	1165	582	Grasselli Dyestuff Corporation	The Grasselli Chemical Company	conveys two tracts as shown	X		
6	11/30/1928	1162	250	E.I. duPont de Nemours and Company	The Grasselli Chemical Company	conveys lands not previously conveyed to Grasselli Dystuff Corp. (exceptions to Tract 5)	X		
7	10/31/1939	1391	302	General Aniline & Film Corporation	General Aniline & Film Corporation	consolidates and renames General Aniline Works And American I.G. Chemicals into General Aniline & Film	X		
8	5/5/1942	1458	210	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	additional acquisition from DuPont	X		
9	9/15/1949	1776	7	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	additional acquisition from DuPont	X		
10	7/7/1950	1847	79	duPont de Nemours	Central Railroad Company of New Jersey	irrevocable license to keep, maintain and use a private access road across railroad property		X	
11	4/18/1951	1898	168	Linden Roselle Sewerage Authority	Sinclair Refining Company	Block 587, Lots 5 & 21	X		
12	1/27/1958	2356	634	General Aniline & Film Corporation	Central Railroad Company of New Jersey	copy not included. believed to convey the railroad property highlighted	X		
13	7/9/1963	2648	319	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	Block 587, Lots 2.01, 2.02	X		
14	1/10/1964	2681	229	City of Linden	General Aniline & Film Corporation	easement for 36" Linden storm sewer		X	
15	11/19/1965	2771	858	Allied Chemical Corporation	Central Railroad Company of New Jersey	grants permission to maintain and use pipeline bridge and pipelines crossing railroad (location uncertain)		X	
16	11/19/1965	2771	862	Allied Chemical Corporation	Central Railroad Company of New Jersey	grants permission to use raodway crossing railroad (location uncertain)		X	
17	1/19/1967	2794	745	General Aniline & Film Corporation	The Central Railroad Company of New Jersey	conveys two tracts as shown	X		
18	5/15/1967	2802	839	General Aniline & Film Corporation	Allied Chemical Corporation	(see next below) - assigns all previous agreements in area from Allied to G .A.& F.		X	
19	5/15/1967	2802	536	General Aniline & Film Corporation	Allied Chemical Corporation	transfers ownership of southeasterly portion of G.A.& F property	X		
20	11/3/1967	2821	929	Union Carbide Corporation	General Aniline & Film Corporation	pipeline eaement in railraod R.O.W.		X	
21	8/20/1970	2909	697	Elizabethtown Gas Company	GAF Corporation	easement following Centerline of Gas Main on north & west sides of property		X	
22	2/24/1971	2917	226	Elizabethtown Water Company	GAF Corporation	amending previous ROW and easement made on 2/26/65 db2739 p990		X	
23	6/1/1971	2924	209	City of Linden	GAF Corporation	amending previous ROW and easement made on 1/10/64 DB 2681 PG 225		X	
24	8/12/1971	2928	677	Buckeye Pipe Line Company	GAF Corporation	petroleum pipeline easement on west side of property		X	
25	4/17/1972	2946	162	City of Linden	GAF Corporation	amending previous ROW and easement made on 1/10/64 db2681 p225 and 6/1/71 (above)		X	
26	7/21/1972	3093	335	Kuehne Chemical Company, Inc.	Linden Chlorine Products, Inc.	cross easement agreement between LCP and Kuehne Chemical Co. (lessor)		X	
27	8/24/1972	2954	273	Linden Chlorine Products	GAF Corporation	**P.Q.** deed for **LCP,** Lots 3.01, 3.02, 3.03 Block 587, references many easements in last 2 pages	X		
28	8/24/1972	2954	284	Linden Chlorine Products	GAF Corporation	right to use 24' roadway known as Linde Road		X	
29	8/24/1972	2954	296	Linden Chlorine Products	GAF Corporation	reciprocal rights over various roadways		X	
30	8/24/1972	2954	312	Linden Chlorine Products	GAF Corporation	rights to use railroad tracks		X	
31	8/24/1972	2954	323	Linden Chlorine Products	GAF Corporation	rights to use Utility Poles and install new ones		X	
32	8/24/1972	2954	331	GAF Corporation	Linden Chlorine Products	ROW/easement for driveway, pipelines, poles, power lines, bridges, and passage ways of any kind		X	
33	8/24/1972	2954	340	GAF Corporation	Linden Chlorine Products	right to use flume and outfall ditch for disposal of its wastewater		X	
34	1/17/1974	2995	280	Northvile Linden Terminal Corp.	GAF Corporation	rights to driveway/road		X	
35	5/8/1975	3033	986	Elizabethtown Water Company	Linden Chlorine Products	two 10' wide water main easements		X	
36	5/22/1975	3034	974	Northvile Linden Terminal Corp.	GAF Corporation	120' x 50' easement, formerly passed on from LCP to GAF in 1972. DB 2954 PG 331		X	
37	3/5/1976	3061	4	Elizabethtown Water Company	Linden Chlorine Products	two 10' wide water main easement		X	
38	12/14/1979	3207	82	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.01, Block 587	X		
39	12/14/1979	3207	93	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.03, Block 587	X		
40	12/14/1979	3207	97	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.02, Block 587	X		
41	8/11/1983	3331	219	Linden Chlorine Products	Kuehne Chemical Company	quit-claim deed releases rights, ROWs, easements and right to purchase... lease made 7/21/1972, db3093 p335		X	
42	9/17/1986	3499	97	GAF Corporation	Linden Chlorine Products	GAF is now leasing the substation from LCP		X	
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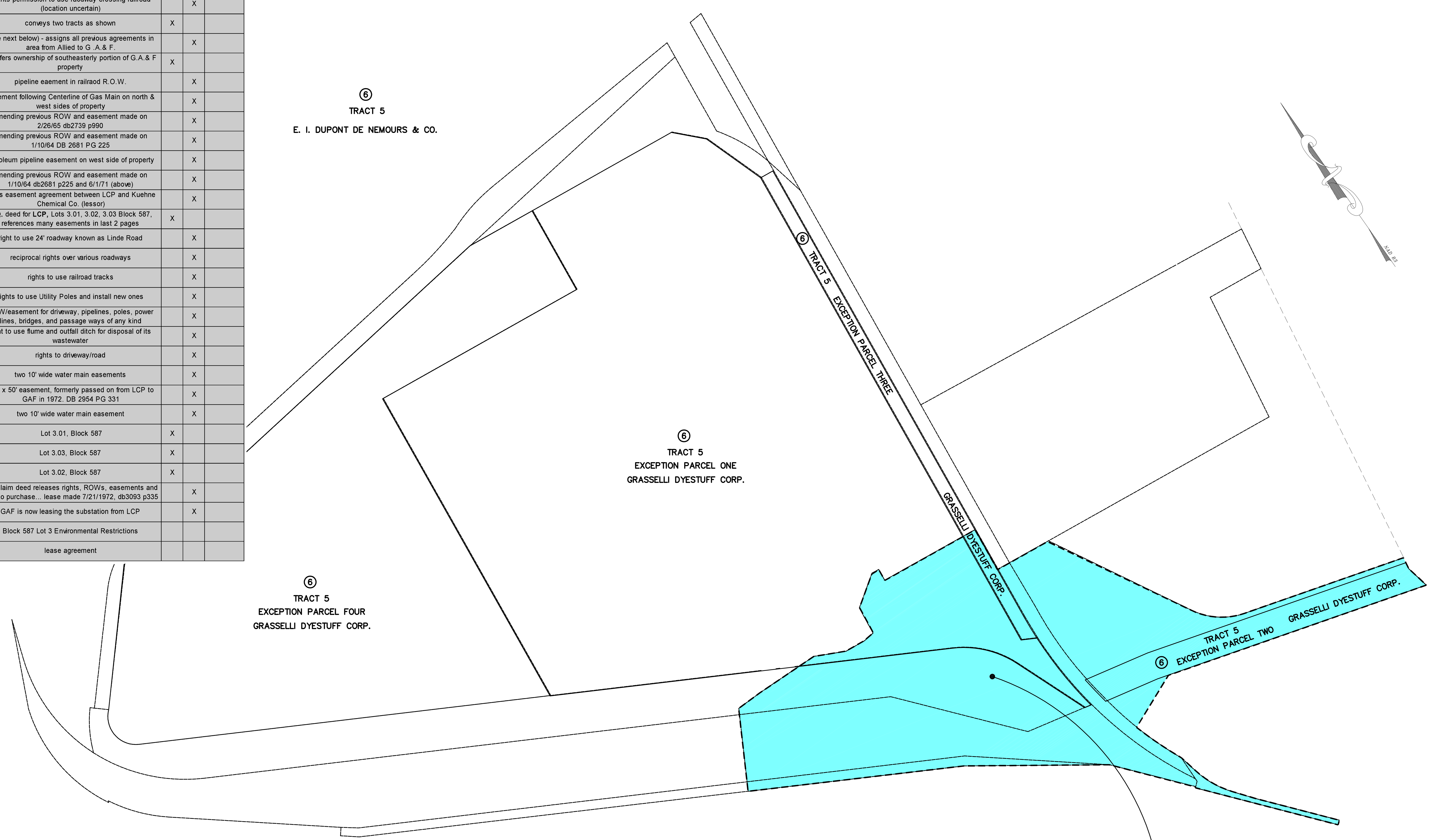

E.I. DUPONT DE NEMOURS & COMPANY - 1928

LCP SITE

REVISIONS 6 5 4 3 2 1

DATE: 4/23/08 SCALE: 1"=200' FLD. BK.:
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Keller & Kirkpatrick Certificate of Authorization #24GA28037400
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CHRONOLOGICAL DEED PLOTTING
FOR
LCP Chemicals & Plastics, Inc.
TAX BLOCK 587
CITY OF LINDEN, UNION COUNTY, NEW JERSEY

SHEET No. 2 OF 6

R2-0003606

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1	7/27/1909	533	233	Borough of Linden	Grasselli Chemical Company	trunk sewer line through property to Staten Island Sound		X	
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5	10/20/1928	1165	582	Grasselli Dyestuff Corporation	The Grasselli Chemical Company	conveys two tracts as shown	X		
6	11/30/1928	1162	250	E.I. duPont de Nemours and Company	The Grasselli Chemical Company	conveys lands not previously conveyed to Grasselli Dystuff Corp. (exceptions to Tract 5)	X		
7	10/31/1939	1391	302	General Aniline & Film Corporation	General Aniline & Film Corporation	consolidates and renames General Aniline Works And American I.G. Chemicals into General Aniline & Film	X		
8	5/5/1942	1458	210	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	additional acquisition from DuPont	X		
9	9/15/1949	1776	7	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	additional acquisition from DuPont	X		
10	7/7/1950	1847	79	duPont de Nemours	Central Railroad Company of New Jersey	irrevocable license to keep, maintain and use a private access road across railroad property		X	
11	4/18/1951	1898	168	Linden Roselle Sewerage Authority	Sinclair Refining Company	Block 587, Lots 5 & 21	X		
12	1/27/1958	2356	634	General Aniline & Film Corporation	Central Railroad Company of New Jersey	copy not included. believed to convey the railroad property highlighted	X		
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18	5/15/1967	2802	839	General Aniline & Film Corporation	Allied Chemical Corporation	(see next below) - assigns all previous agreements in area from Allied to G .A.& F.		X	
19	5/15/1967	2802	536	General Aniline & Film Corporation	Allied Chemical Corporation	transfers ownership of southeasterly portion of G.A.& F property	X		
20	11/3/1967	2821	929	Union Carbide Corporation	General Aniline & Film Corporation	pipeline eaement in railraod R.O.W.		X	
21	8/20/1970	2909	697	Elizabethtown Gas Company	GAF Corporation	easement following Centerline of Gas Main on north & west sides of property		X	
22	2/24/1971	2917	226	Elizabethtown Water Company	GAF Corporation	amending previous ROW and easement made on 2/26/65 db2739 p990		X	
23	6/1/1971	2924	209	City of Linden	GAF Corporation	amending previous ROW and easement made on 1/10/64 DB 2681 PG 225		X	
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27	8/24/1972	2954	273	Linden Chlorine Products	GAF Corporation	**P.Q.** deed for **LCP,** Lots 3.01, 3.02, 3.03 Block 587, references many easements in last 2 pages	X		
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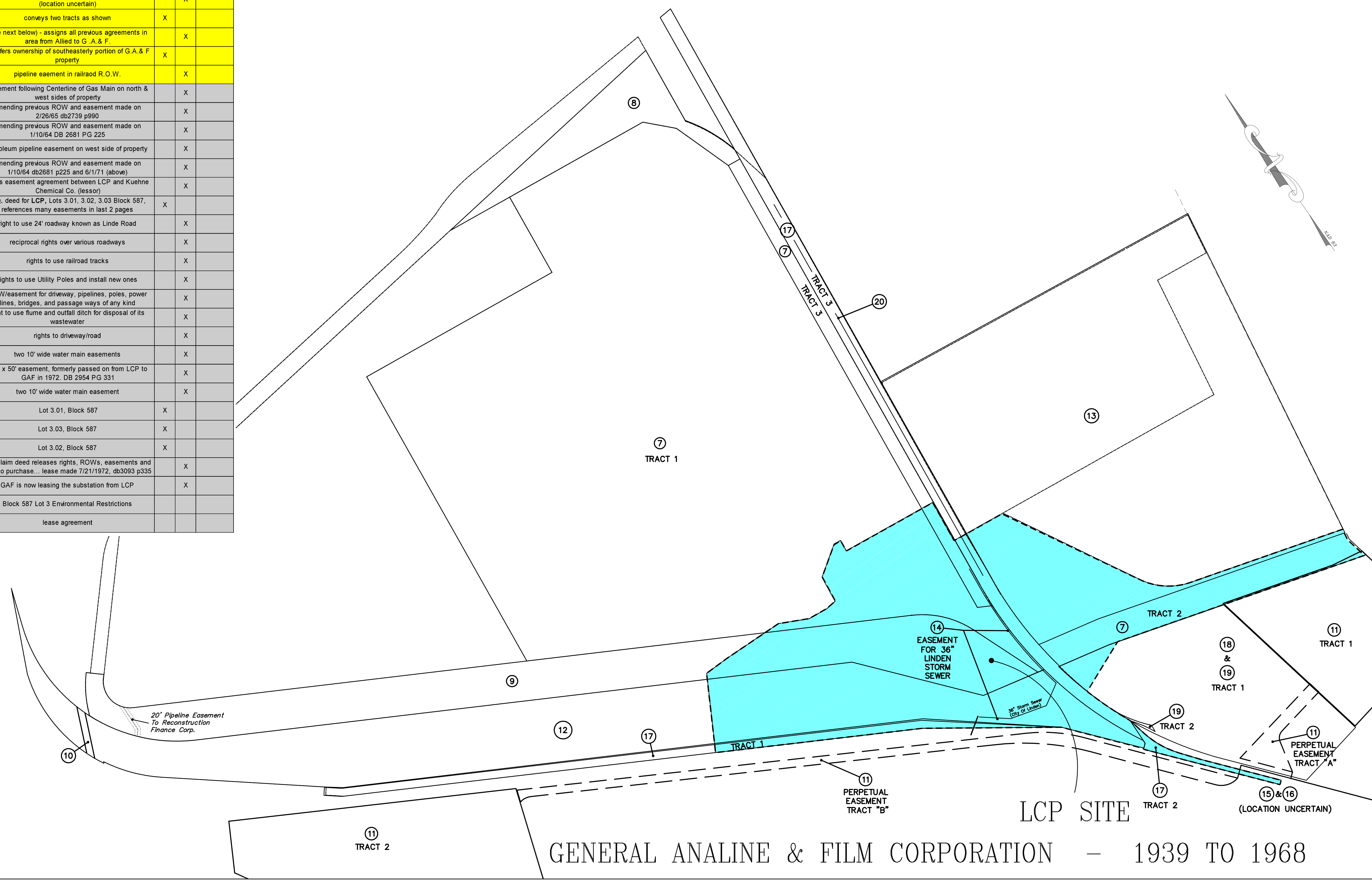

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REVISIONS

DATE: 4/23/08 SCALE: 1"=200' FLD. BK.:
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0 100 200 400 800

Keller & Kirkpatrick Certificate of Authorization #24GA28037400
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CHRONOLOGICAL DEED PLOTTING
FOR
LCP Chemicals & Plastics, Inc.
TAX BLOCK 587
CITY OF LINDEN, UNION COUNTY, NEW JERSEY

SHEET No. 3 OF 6

R2-0003607

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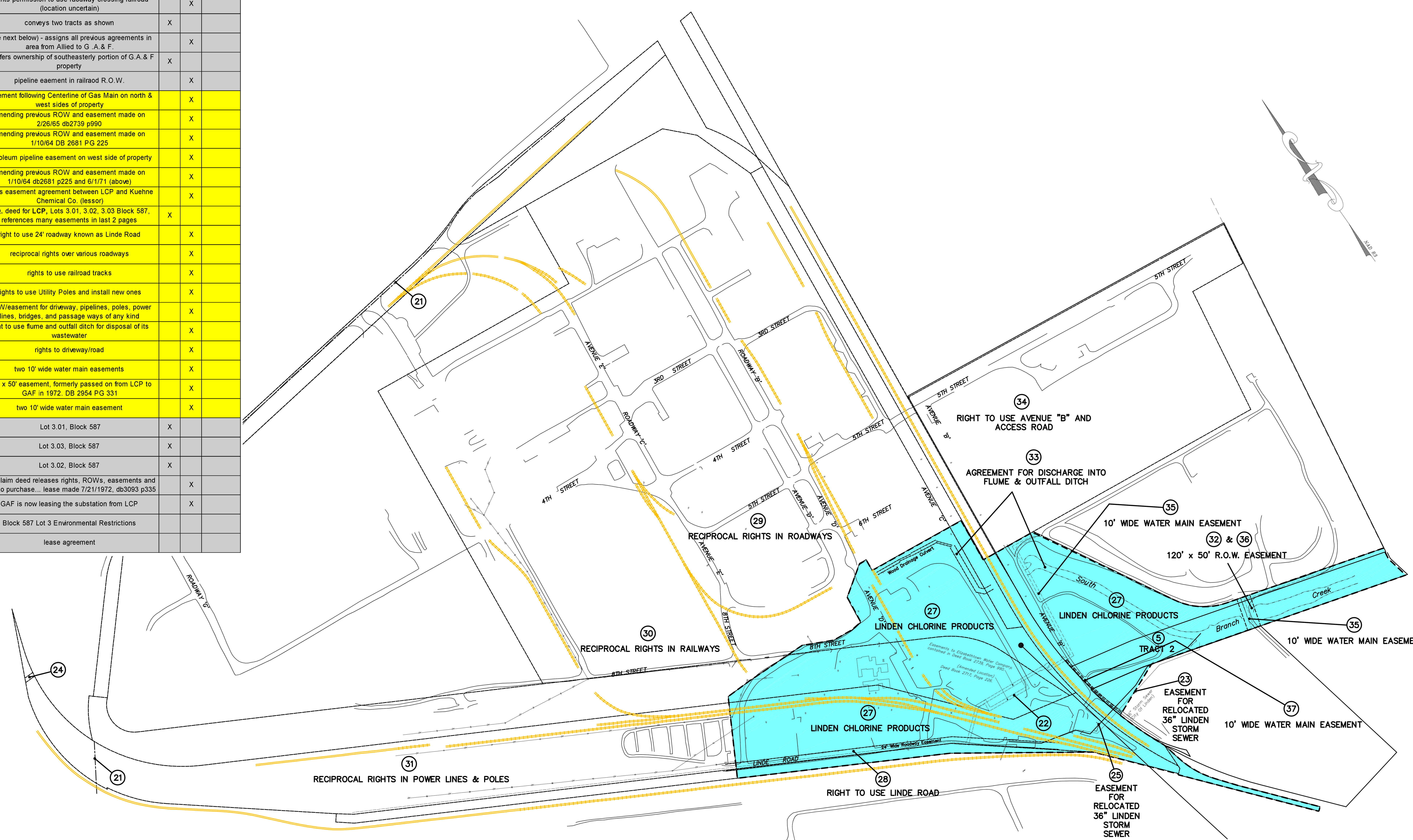

GAF CORPORATION – 1968–1978

LCP SITE

REVISIONS 1 2 3 4 5 6

DATE: 4/23/08 SCALE: 1"=200' FLD. BK.:
PROJ.: 2001202 CHKD.: PAGE:

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Keller & Kirkpatrick Certificate of Authorization #24GA28037400
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CONSULTING ENGINEERS LAND SURVEYORS
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CHRONOLOGICAL DEED PLOTTING FOR
LCP Chemicals & Plastics, Inc.
TAX BLOCK 587
CITY OF LINDEN, UNION COUNTY, NEW JERSEY

SHEET No. 4 OF 6

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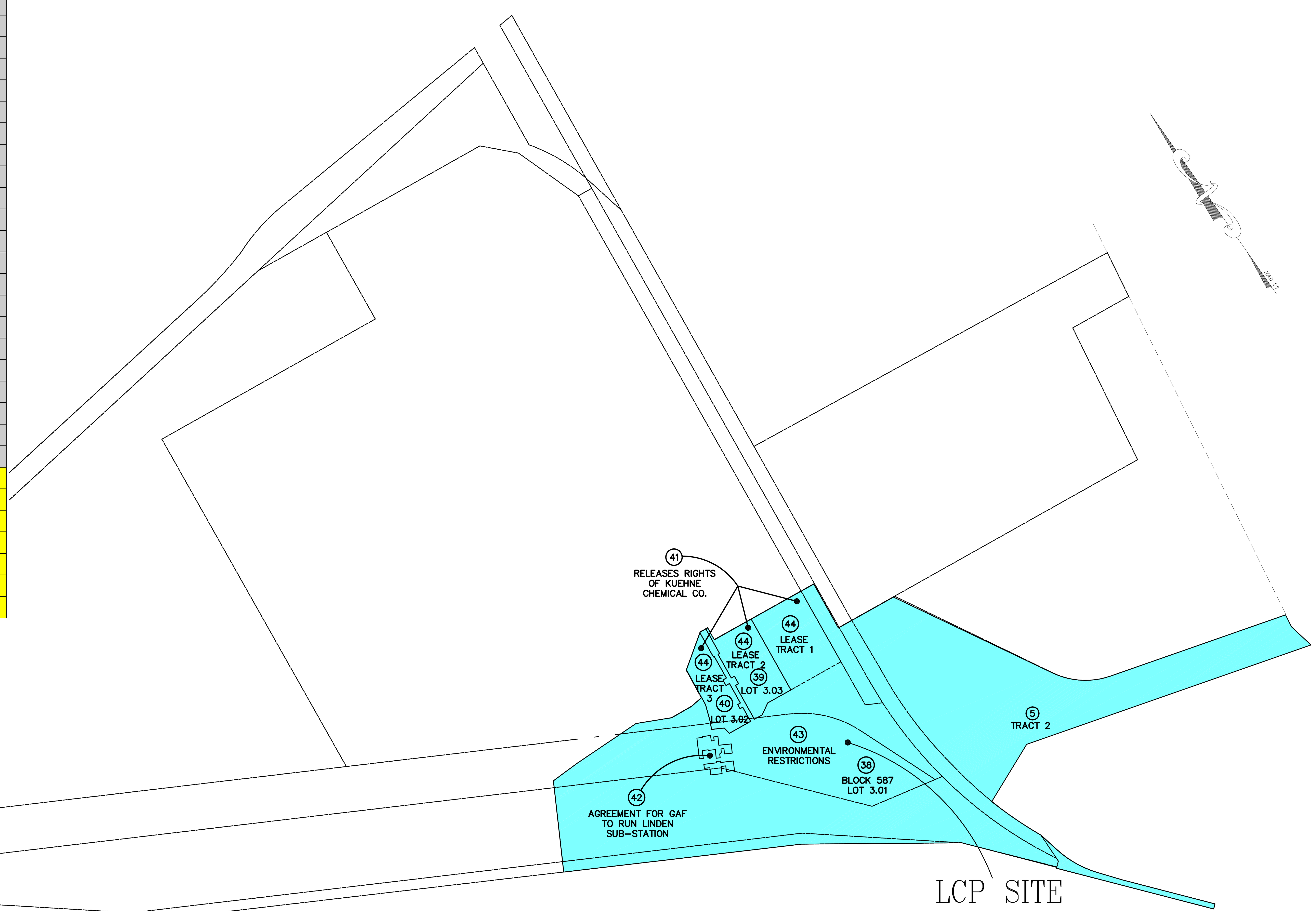
8	5/5/1942	1458	210	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	additional acquisition from DuPont	X		
9	9/15/1949	1776	7	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	additional acquisition from DuPont	X		
10	7/7/1950	1847	79	duPont de Nemours	Central Railroad Company of New Jersey	irrevocable license to keep, maintain and use a private access road across railroad property		X	
11	4/18/1951	1898	168	Linden Roselle Sewerage Authority	Sinclair Refining Company	Block 587, Lots 5 & 21	X		
12	1/27/1958	2356	634	General Aniline & Film Corporation	Central Railroad Company of New Jersey	copy not included. believed to convey the railroad property highlighted	X		
13	7/9/1963	2648	319	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	Block 587, Lots 2.01, 2.02	X		
14	1/10/1964	2681	229	City of Linden	General Aniline & Film Corporation	easement for 36" Linden storm sewer		X	
15	11/19/1965	2771	858	Allied Chemical Corporation	Central Railroad Company of New Jersey	grants permission to maintain and use pipeline bridge and pipelines crossing railroad (location uncertain)		X	
16	11/19/1965	2771	862	Allied Chemical Corporation	Central Railroad Company of New Jersey	grants permission to use raodway crossing railroad (location uncertain)		X	
17	1/19/1967	2794	745	General Aniline & Film Corporation	The Central Railroad Company of New Jersey	conveys two tracts as shown	X		
18	5/15/1967	2802	839	General Aniline & Film Corporation	Allied Chemical Corporation	(see next below) - assigns all previous agreements in area from Allied to G .A.& F.		X	
19	5/15/1967	2802	536	General Aniline & Film Corporation	Allied Chemical Corporation	transfers ownership of southeasterly portion of G.A.& F property	X		
20	11/3/1967	2821	929	Union Carbide Corporation	General Aniline & Film Corporation	pipeline eaement in railraod R.O.W.		X	
21	8/20/1970	2909	697	Elizabethtown Gas Company	GAF Corporation	easement following Centerline of Gas Main on north & west sides of property		X	
22	2/24/1971	2917	226	Elizabethtown Water Company	GAF Corporation	amending previous ROW and easement made on 2/26/65 db2739 p990		X	
23	6/1/1971	2924	209	City of Linden	GAF Corporation	amending previous ROW and easement made on 1/10/64 DB 2681 PG 225		X	
24	8/12/1971	2928	677	Buckeye Pipe Line Company	GAF Corporation	petroleum pipeline easement on west side of property		X	
25	4/17/1972	2946	162	City of Linden	GAF Corporation	amending previous ROW and easement made on 1/10/64 db2681 p225 and 6/1/71 (above)		X	
26	7/21/1972	3093	335	Kuehne Chemical Company, Inc.	Linden Chlorine Products, Inc.	cross easement agreement between LCP and Kuehne Chemical Co. (lessor)		X	
27	8/24/1972	2954	273	Linden Chlorine Products	GAF Corporation	**P.Q.** deed for **LCP,** Lots 3.01, 3.02, 3.03 Block 587, references many easements in last 2 pages	X		
28	8/24/1972	2954	284	Linden Chlorine Products	GAF Corporation	right to use 24' roadway known as Linde Road		X	
29	8/24/1972	2954	296	Linden Chlorine Products	GAF Corporation	reciprocal rights over various roadways		X	
30	8/24/1972	2954	312	Linden Chlorine Products	GAF Corporation	rights to use railroad tracks		X	
31	8/24/1972	2954	323	Linden Chlorine Products	GAF Corporation	rights to use Utility Poles and install new ones		X	
32	8/24/1972	2954	331	GAF Corporation	Linden Chlorine Products	ROW/easement for driveway, pipelines, poles, power lines, bridges, and passage ways of any kind		X	
33	8/24/1972	2954	340	GAF Corporation	Linden Chlorine Products	right to use flume and outfall ditch for disposal of its wastewater		X	
34	1/17/1974	2995	280	Northvile Linden Terminal Corp.	GAF Corporation	rights to driveway/road		X	
35	5/8/1975	3033	986	Elizabethtown Water Company	Linden Chlorine Products	two 10' wide water main easements		X	
36	5/22/1975	3034	974	Northvile Linden Terminal Corp.	GAF Corporation	120' x 50' easement, formerly passed on from LCP to GAF in 1972. DB 2954 PG 331		X	
37	3/5/1976	3061	4	Elizabethtown Water Company	Linden Chlorine Products	two 10' wide water main easement		X	
38	12/14/1979	3207	82	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.01, Block 587	X		
39	12/14/1979	3207	93	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.03, Block 587	X		
40	12/14/1979	3207	97	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.02, Block 587	X		
41	8/11/1983	3331	219	Linden Chlorine Products	Kuehne Chemical Company	quit-claim deed releases rights, ROWs, easements and right to purchase... lease made 7/21/1972, db3093 p335		X	
42	9/17/1986	3499	97	GAF Corporation	Linden Chlorine Products	GAF is now leasing the substation from LCP		X	
43	9/23/1994	4228	125		Linden Chlorine Products	Block 587 Lot 3 Environmental Restrictions			
44	7/21/1972	3093	335	Kuehne Chemical Company, Inc.	Linden Chlorine Products	lease agreement			



LCP CHEMICALS - NEW JERSEY, INC - 1979 TO 1994 & KUEHNE LEASE - 1972

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REVISIONS

DATE: 4/23/08 SCALE: 1"=200' FLD. BK.:

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Keller & Kirkpatrick Certificate of Authorization #24GA28037400

301 Gibraltar Drive, Suite 2A, Morris Plains, NJ, 07950 973-377-8500

CONSULTING ENGINEERS
LAND SURVEYORS

LANDSCAPE ARCHITECTS
PLANNERS

WERNER A. MALL, Professional Land Surveyor, Lic. 37201
GEORGE P. JAMES, Professional Engineer, Lic. 22934

CHRONOLOGICAL DEED PLOTTING
FOR
LCP Chemicals & Plastics, Inc.
TAX BLOCK 587
CITY OF LINDEN, UNION COUNTY, NEW JERSEY

SHEET No. 5 OF 6

R2-0003609

TABLE OF DOCUMENTS SUPPLIED

No.	Date	Book	Page	Grantee	Grantor	Description	Prop-erty	Ease-ment	
1	7/27/1909	533	233	Borough of Linden	Grasselli Chemical Company	trunk sewer line through property to Staten Island Sound		X	
2	9/27/1909	533	589	Borough of Linden	Tremley Point Corporation	Trunk Sewer line through property		X	
3	2/28/1912	588	499	Borough of Linden	Edward F. Robinson	Trunk Sewer line through property		X	
4	10/20/1928	1165	576	Grasselli Dyestuff Corporation	The Grasselli Chemical Company	conveys two tracts as shown	X		
5	10/20/1928	1165	582	Grasselli Dyestuff Corporation	The Grasselli Chemical Company	conveys two tracts as shown	X		
6	11/30/1928	1162	250	E.I. duPont de Nemours and Company	The Grasselli Chemical Company	conveys lands not previously conveyed to Grasselli Dystuff Corp. (exceptions to Tract 5)	X		
7	10/31/1939	1391	302	General Aniline & Film Corporation	General Aniline & Film Corporation	consolidates and renames General Aniline Works And American I.G. Chemicals into General Aniline & Film	X		
8	5/5/1942	1458	210	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	additional acquisition from DuPont	X		
9	9/15/1949	1776	7	General Aniline & Film Corporation	E.I. duPont de Nemours and Company	additional acquisition from DuPont	X		
10	7/7/1950	1847	79	duPont de Nemours	Central Railroad Company of New Jersey	irrevocable license to keep, maintain and use a private access road across railroad property		X	
11	4/18/1951	1898	168	Linden Roselle Sewerage Authority	Sinclair Refining Company	Block 587, Lots 5 & 21	X		
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36	5/22/1975	3034	974	Northvile Linden Terminal Corp.	GAF Corporation	120' x 50' easement, formerly passed on from LCP to GAF in 1972. DB 2954 PG 331		X	
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39	12/14/1979	3207	93	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.03, Block 587	X		
40	12/14/1979	3207	97	LCP Chemicals--New Jersey, Inc.	LCP Chemicals & Plastics, Inc	Lot 3.02, Block 587	X		
41	8/11/1983	3331	219	Linden Chlorine Products	Kuehne Chemical Company	quit-claim deed releases rights, ROWs, easements and right to purchase... lease made 7/21/1972, db3093 p335		X	
42	9/17/1986	3499	97	GAF Corporation	Linden Chlorine Products	GAF is now leasing the substation from LCP		X	
43	9/23/1994	4228	125		Linden Chlorine Products	Block 587 Lot 3 Environmental Restrictions			
44	7/21/1972	3093	335	Kuehne Chemical Company, Inc.	Linden Chlorine Products	lease agreement			

COLOR CHART

GRASSELLI CHEMICAL COMPANY TO GRASSELLI DYESTUFF CORPORATION – PRIOR TO 1928 (4) & (5)

TRANSFERRED FROM E.I. DUPONT DE NEMOURS & CO. TO GENERAL ANILINE & FILM CORPORATION – 1940–1963 (8)(9) & (13)

TRANSFERRED FROM CENTRAL RILROAD CO. OF N.J. TO GENERAL ANILINE & FILM COROPORATION – 1958 (12)

TRANSFERRED FROM ALLIED CHEMICAL CORP. TO G A F CORPORATION – 1967 (19)

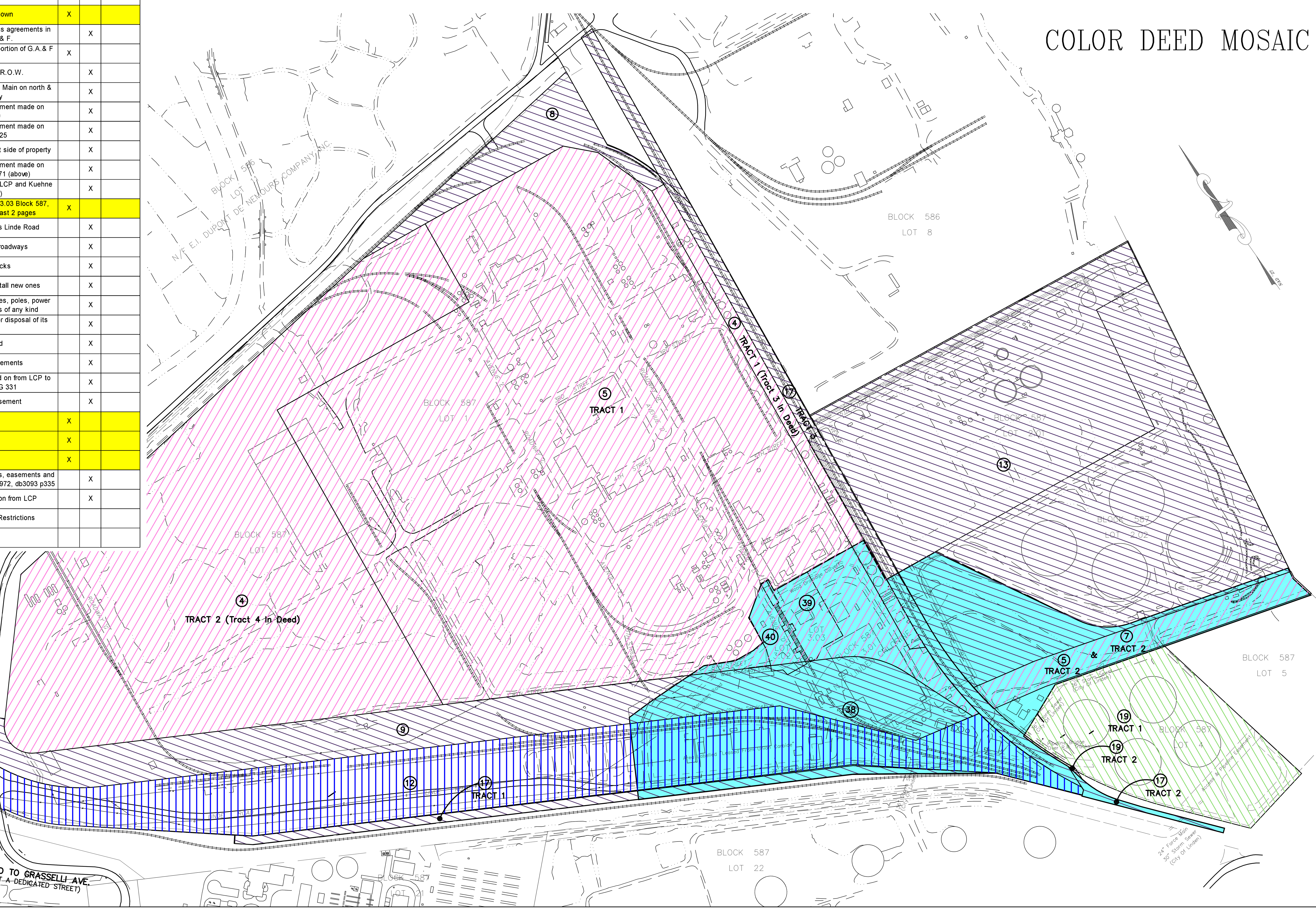
CONVEYED BY GAF CORPORATION TO LINDEN CHLORINE PRODUCTS – 1972 (27)
&
CONVEYED BY LINDEN CHLORINE PRODUCTS TO L C P CHEMICALS–NEW JERSEY, INC. – 1979 (38) (39) & (40)

NOTE: NOTE: SITE INTERIOR DETAILS SHOWN HEREON REPRESENT SITE CONDITIONS AS OF THE AERIAL SURVEY PERFORMED ON 4/05/02 AND DO NOT REFLECT PRESENT SITE CONDITIONS.

CORPORATE NAME CHANGES

GRASSELLI DYESTUFF CORPORATION WAS INCORPORATED UNDER THE LAWS OF THE STATE OF DELAWARE. ON FEBRUARY 27, 1929, IT CHANGED ITS NAME TO GENERAL ANILINE WORKS, INC. ON OCTOBER 30, 1939, IT BECAME KNOWN AS GENERAL ANILINE & FILM CORPORATION. ON OCTOBER 31, 1939, IT MERGED INTO AMERICAN I.G. CHEMICAL CORPORATION. ON APRIL 24, 1968, IT CHANGED ITS NAME TO GAF CORPORATION. ON AUGUST 24, 1972, GAF CONVEYED PROPERTY TO LINDEN CHLORINE PRODUCTS, INC. ON DECEMBER 14, 1979, LCP CHEMICALS & PLASTICS, INC. CONVEYED ITS PROPERTY TO LCP CHEMICALS–NEW JERSEY, INC.

COLOR DEED MOSAIC



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DATE: 4/23/08 SCALE: 1"=200' FLD. BK.:
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Keller & Kirkpatrick Certificate of Authorization #24GA28037400
301 Gibraltar Drive, Suite 2A, Morris Plains, NJ, 07950 973-377-8500
CONSULTING ENGINEERS LAND SURVEYORS LANDSCAPE ARCHITECTS PLANNERS
WERNER A. MALL, Professional Land Surveyor, Lic. 37201
GEORGE P. JAMES, Professional Engineer, Lic. 22934

CHRONOLOGICAL DEED PLOTTING
FOR
LCP Chemicals & Plastics, Inc.
TAX BLOCK 587
CITY OF LINDEN, UNION COUNTY, NEW JERSEY

SHEET No. 6 OF 6

Exhibit F

FEDERAL REGISTER

Notices

TREASURY DEPARTMENT

Monetary Offices

VESTING ORDER PURSUANT TO SECTION 5 (b) OF THE TRADING WITH THE ENEMY ACT, AS AMENDED

VESTING ORDER NO. I RELATING TO SHARES OF STOCK OF THE GENERAL ANILINE & FILM CORP., OF DELAWARE

7 FR 1046

DATE: February 17, 1942

SUMMARY: I, Henry Morgenthau, Jr., Secretary of the Treasury, acting under and by virtue of the authority vested in me by the Prestilent pursuant to section 5 (b) 6f the Act of October 6, 1917, as amended by section 301 of the First War Powers Act, 1941, finding after investigation that the following shares of the stock of the General Aniline & Film Corporation, a corporation organized under the laws of the State of Delaware, are the property of nationals of a foreign country designated in Executive Order No. 8389, as amended, as defined therein, and that the action herein taken is in the public interest, do hereby order and declare that such shares Including all interest therein are hereby vested in the Secretary of the Treasury to be held, used, administered, liquidated, sold or otherwise dealt with in the interest of and for the benefit of the United States:

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involved has been made, and the said Division, on the date hereof, has made and filed a report herein containing its findings of fact and conclusions thereon, which report is hereby referred to and made a part hereof;[1]

It is ordered, That effective April 1, 1942, until further order of the Commission, the Code of Federal Regulations be, and it is hereby, amended as follows:

§ 200.300 *Information required to be recorded.* Every passenger broker subject to section 211 of the Interstate Commerce Act shall maintain and keep an exact record of all transactions in which it or he has participated as such broker, which records shall show: (a) The points of origin and destination for each ticket sold, (b) the name and address of the motor carrier for which it is sold, (c) the amount received from the passenger, including any amounts, stated separately, for the transportation of baggage, or any other service accessorial to the transportation of the passenger, (d) the payments made to each carrier by motor vehicle served by the broker and (e) the amounts of the commissions earned by the broker from the sale of transportation for each carrier. (Sec. 204 (a) (4), 49 Stat. 546, sec. 211 (c), (d), 49 Stat. 554; 49 U.S.C. 304 (a) (4), 311 (c), (d))

By the Commission, division 1.

[SEAL] W. P. BARTEL, *Secretary.*

[F. R. Doc. 42-1358; Filed, February 16, 1942; 10:48 a. m.]

[1] Filed as part of the original document.

Notices

TREASURY DEPARTMENT.

Monetary Offices.

VESTING ORDER PURSUANT TO SECTION 5 (b) OF THE TRADING WITH THE ENEMY ACT, AS AMENDED

VESTING ORDER NO. 1 RELATING TO SHARES OF STOCK OF THE GENERAL ANILINE & FILM CORP., OF DELAWARE

I, Henry Morgenthau, Jr., Secretary of the Treasury, acting under and by virtue of the authority vested in me by the President pursuant to section 5 (b) of the Act of October 6, 1917, as amended by section 301 of the First War Powers Act, 1941, finding after investigation that the following shares of the stock of the General Aniline & Film Corporation, a corporation organized under the laws of the State of Delaware, are the property of nationals of a foreign country designated in Executive Order No. 8389, as amended, as defined therein, and that the action herein taken is in the public interest, do hereby order and declare that such shares including all interest therein are hereby vested in the Secretary of the Treasury to be held, used, administered, liquidated, sold or otherwise dealt with in the interest of and for the benefit of the United States:

Certificate No.	Number of shares	Class of shares	Registered in the name of—
027	1,500	A	Geheimrat Professor Dr. Carl Bosch, Ludwigshafen, Germany.
028	500	A	Geheimrat Professor Dr. Carl Bosch, Ludwigshafen, Germany.
023	1,500	A	Geheimrat Dr. Hermann Schmitz, Berlin, Germany.
029	500	A	Geheimrat Dr. Hermann Schmitz, Berlin, Germany.
0656	20,000	A	Osmon Aktiengesellschaft, Schaffhausen, Switzerland.
0657	10,000	A	
0658	10,000	A	
0659	10,000	A	
0660	5,000	A	
0661	5,000	A	
0662	5,000	A	
0663	500	A	
0664	500	A	
0665	500	A	
0720	132	A	
022	300,000	A	International Gesellschaft für Chemische Unternehmungen Aktiengesellschaft, Basel, Switzerland.
137	100	A	
061	50	A	
065	90	A	
092	726	A	
095	500	A	
0568	10,000	A	
0569	10,000	A	
0570	10,000	A	
0571	10,000	A	
0572	10,000	A	
0573	10,000	A	International Gesellschaft für Chemische Unternehmungen Aktiengesellschaft, Basel, Switzerland.
0574	5,000	A	
0575	5,000	A	
0576	5,000	A	
0577	5,000	A	
0578	5,000	A	
0579	1,000	A	
0580	1,000	A	
0581	1,000	A	
0582	350	A	
BB 13	650,000	B	L. D. Pickering & Company in custody for N. V. Maatschappij voor Industrie en Handelsbelangen, Amsterdam, The Netherlands.
32	100,000	B	N. V. Maatschappij voor Industrie en Handelsbelangen, Amsterdam, The Netherlands.
33	100,000	B	
34	100,000	B	
1	400,000	B	Chemo Maatschappij voor Chemische Ondernehmungen, Amsterdam, The Netherlands.
20	200,000	B	
4	500,000	B	Banque Federale (Eidgenossische Bank, A. G.) Zurich, Switzerland.

Such property and any proceeds thereof shall be held in a special account pending further determination of the Secretary of the Treasury. This shall not be deemed to limit the power of the Secretary of the Treasury to return such property or the proceeds thereof, or to indicate that compensation will not be paid in lieu thereof, if and when it should be determined that such return or compensation should be made.

Any person not a national of a foreign country designated in Executive Order No. 8389, as amended, asserting any interest in said shares of stock or any party asserting any claim as a result of this Order may file with the Secretary of the Treasury a notice of his claim, together with a request for hearing thereon, on Form TFVP-1 within one year of the date of this Order, or within such further time as may be allowed by the Secretary of the Treasury.

This Order shall be published in the FEDERAL REGISTER.

By direction of the President.

[SEAL] H. MORGENTHAU, Jr., *Secretary of the Treasury.*

FEBRUARY 16, 1942.

[F. R. Doc. 42-1359; Filed, February 16, 1942; 10:33 a. m.]

DEPARTMENT OF THE INTERIOR.

Bituminous Coal Division.

[Docket No. B-198]

IN THE MATTER OF BOOTH, INC., REGISTERED DISTRIBUTOR, REGISTRATION NO. 0928

NOTICE OF AND ORDER FOR HEARING

The Bituminous Coal Division (the "Division") finds it necessary in the proper administration of the Bituminous Coal Act of 1937 (the "Act") and the Bituminous Coal Code (the "Code") promulgated thereunder to determine

A. Whether or not Booth, Inc., Registered Distributor, Registration No. 0928 (hereinafter sometimes referred to as the "Registered Distributor") whose address is Kenova, W. Va., has violated any provisions of the Act, the Code, and orders and regulations of the Division, including the Marketing Rules and Regulations, Rules and Regulations for the Registration of Distributors, and the Distributor's Agreement (the "Agreement") dated October 19, 1940, and filed by Booth, Inc., pursuant to Order of the Division dated June 19, 1940, in General Docket No. 12, and more particularly whether or not subsequent to September 30, 1940, said registered distributor:

1. During the period May 27, 1941, to June 7, 1941, both dates inclusive, acting as sales agent for the code member producers hereinafter named, made the following substitutions and sales:

(a) substitution of 419.05 tons of 2" x 5" egg coal produced at the Sellards No. 1 mine (Mine Index No. 2431) of Left Fork Fuel Company, Inc., a code member in District No. 8, on railway fuel orders obtained from the Ann Arbor Railway Company, specifying 6" resultant mine run coal, and sale of said coal to said railway company at the price of $1.85 per net ton f. o. b. said mine, the applicable mine price for such egg coal being $2.30 per net ton f. o. b. the mine;

(b) substitution of 418.5 tons of 2" x 5" egg coal produced at the Camp Creek Coal Company Mine (Mine Index No. 2420) of A. J. Fry, a code member in District No. 8, on railway fuel orders obtained from the Ann Arbor Railway Company specifying 6" resultant mine run coal, and sale of said coal to said railway company at the price of $1.85 per net ton f. o. b. said mine, the applicable mine price for such egg coal being $2.30 per net ton f. o. b. the mine;

(c) Substitution of 200 tons of 2" x 5" egg coal produced at the Hall Brothers Mine (Mine Index No. 2421) of J. C. Fry and Andrew J. Fry, co-partners, doing business under the name and style of J. C. Fry and A. J. Fry, a code member in District No. 8, on railway fuel orders obtained from the Ann Arbor Railway Company specifying 6" resultant mine run coal, and sale of said coal to said railway company at the price of $1.85 per net ton f. o. b. said mine, the applicable mine price for such egg coal being $2.30 per net ton f. o. b. the mine; and

FEDERAL REGISTER

Rules and Regulations

TITLE 8--ALIENS AND NATIONALITY

Chapter II--Office of the Alien Property Custodian

PART 502--VESTING ORDERS

VESTING OF PROPERTY OF GENERAL ANILINE AND FILM: CORPORATION OF DELAWARE

7 FR 3148

DATE: April 30, 1942

SUMMARY: § 502.5 Vesting 'Order No. 5. (a) I, Leo T. Crowley, Alien Property Custodian, acting under and by virtue of the authority vested in me by the President pursuant to section 5 (b) of the Act of October 6, 1917, as amended by section 301 of the First War Powers Act, 1941, and pursuant to Executive Order No. 9095, dated March 11, 1942, finding upon investigation that the shares of stock of General Aniline and Film Corporation of Delaware which were covered by the vesting order Issued by the Secretary of the Treasury under date of February 16, 1942, and which are described therein, were at the time of the issuance of such vesting order the property of Nationals of a Foreign Country designated in Executive Order No. 8389, as amended,as defined therein, and that the action herein taken is in the public interest, do hereby order and declare that said shares (or, in the event any or all of them have been cancelled and new shares issued in lieu thereof, then such new shares representing a corresponding property ownership or interest in such corporation), including all interest therein, are hereby vested in the Allen Property Custodian to be held used, administered, liquidated, sold or otherwise dealt with In the interest of and for the benefit of the United States.

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milk is received from producers, which is allocated to Class I, times the Class I price, less the Class II price, computed pursuant to § 945.5, add the resulting values together, and divide by the hundredweight of milk received from producers.

11. Throughout § 945.7 (b) (1) and (2) substitute "14th" for "11th" and in § 945.7 (b) (1) (iii) substitute "Class II" for "Class III".

12. Delete § 945.8 (a) and substitute therefor the following:

(a) *Time and method of payment*—(1) *Semimonthly payments.* On or before the last day of each delivery period, each handler shall make payment to producers for milk delivered during the first 15 days of such period at not less than a rate per hundredweight which is estimated will be his uniform price for such month.

(2) *Final payments.* On or before the 18th day after the end of each delivery period, each handler shall make full payment, subject to paragraphs (b), (c), (d), and (e) of this section for the total value of milk received from producers and associations of producers during the delivery period computed pursuant to § 945.7, after taking credit for payments made pursuant to § 945.8 (a) (1), except as provided for in paragraph (f) of this section, as follows:

(i) To each producer except as provided in subdivision (ii) of this subparagraph at not less than the composite price for milk containing 4 percent butterfat, computed pursuant to § 945.7.

(ii) To a cooperative association for (a) milk which is caused to be delivered to a handler from producers by a cooperative association, and for which such cooperative association collects payment, a total amount equal to not less than the sum of the individual payments otherwise payable to such producers under subdivision (i) of this subparagraph minus an amount equal to the hundredweight of milk or milk equivalent of cream disposed of for the account of the association times the composite price plus the amount of skim milk retained from such milk and cream (at the average test of milk received from producers) times 110 percent of the skim value computed pursuant to § 945.5 (a) (2) (ii) less 23½ cents, and (b) other milk or cream, in each use classification determined pursuant to § 945.4 (c) and (d), respectively, received by such handler for the account of an association of producers at not less than the class prices specified in § 945.5, plus the weighted average premium per hundredweight payable to producers by such handler.

13. Delete the words "5 cents per hundredweight" in § 945.8 (c) and substitute therefor the following:

"an amount per hundredweight of milk equal to one-fortieth of the price for butterfat computed pursuant to § 945.5 (a) (2) (i)."

14. In § 945.8 (e) substitute "Class I milk" for "combined total of Class I milk and Class II milk."

15. In § 945.9 (a) and (b), delete the words "not more than 7½ cents per test" and substitute therefor "one-half the cost per test". Also delete the words "15th day" and substitute therefor "18th day".

16. In § 945.9 (a) delete the words "and Class II".

(48 Stat. 31, 670, 675 (1933); 49 Stat. 750 (1935); 50 Stat. 246 (1937); 7 U.S.C., and Supp. 601 et seq.)

Issued at Washington, D. C., this 28th day of April 1942, to become effective on and after the 1st day of May 1942. Witness my hand and the official seal of the Department of Agriculture.

[SEAL] GROVER B. HILL,
Acting Secretary of Agriculture.

[F. R. Doc. 42-3829; Filed, April 28, 1942; 4:40 p. m.]

TITLE 8—ALIENS AND NATIONALITY

Chapter II—Office of the Alien Property Custodian

PART 502—VESTING ORDERS

VESTING OF PROPERTY OF GENERAL ANILINE AND FILM CORPORATION OF DELAWARE

§ 502.5 *Vesting Order No. 5.* (a) I, Leo T. Crowley, Alien Property Custodian, acting under and by virtue of the authority vested in me by the President pursuant to section 5 (b) of the Act of October 6, 1917, as amended by section 301 of the First War Powers Act, 1941, and pursuant to Executive Order No. 9095, dated March 11, 1942, finding upon investigation that the shares of stock of General Aniline and Film Corporation of Delaware which were covered by the vesting order issued by the Secretary of the Treasury under date of February 16, 1942, and which are described therein, were at the time of the issuance of such vesting order the property of Nationals of a Foreign Country designated in Executive Order No. 8389, as amended,[1] as defined therein, and that the action herein taken is in the public interest, do hereby order and declare that said shares (or, in the event any or all of them have been cancelled and new shares issued in lieu thereof, then such new shares representing a corresponding property ownership or interest in such corporation), including all interest therein, are hereby vested in the Alien Property Custodian to be held used, administered, liquidated, sold or otherwise dealt with in the interest of and for the benefit of the United States.

(b) Such property and any proceeds thereof shall be held in a special account pending further determination of the Alien Property Custodian. This shall not be deemed to limit the power of the Alien Property Custodian to return such property or the proceeds thereof, or to indicate that compensation will not be paid in lieu thereof, if and when it should be determined that such return or compensation should be made.

(c) Any person not a national of a foreign country designated in Executive Order No. 8389, as amended, asserting any interest in said property, or any party asserting any claim as a result of this order, may file with the Alien Property Custodian a notice of his claim, together with a request for hearing thereon, on Form APC-1 within one year of the date of this order, or within such further time as may be allowed by the Alien Property Custodian. (E.O. 9095, 7 F.R. 1971)

This order shall be published in the FEDERAL REGISTER.

LEO T. CROWLEY,
Alien Property Custodian.

APRIL 24, 1942.

[F. R. Doc. 42-3865; Filed, April 29, 1942; 11:47 a. m.]

[1] 6 F.R. 2897, 3715, 6348, 6785.

TITLE 10—ARMY: WAR DEPARTMENT

Chapter VII—Personnel

PART 71—ENLISTMENT IN THE REGULAR ARMY[1]

SUSPENSION OF CERTAIN REGULATIONS PERTAINING TO EXAMINATION AND ENLISTMENT, WITH EXCEPTIONS

§ 71.22 *Physical examination of applicants for enlistment.*
(a) * * *

* * * * *

(2) Individuals may be accepted as applicants for enlistment at recruiting stations which lack complete examination facilities, but actually enlisted only at recruiting or induction stations which do have complete examination facilities. So much of §§ 71.9 to 71.14, inclusive as conflicts with the above is suspended. (41 Stat. 765; 10 U.S.C. 42) [Cir. 112, W.D., April 15, 1942]

* * * * *

[SEAL] J. A. ULIO,
Major General,
The Adjutant General.

[F. R. Doc. 42-3782; Filed, April 28, 1942; 1:21 p. m.]

[1] § 71.22 is amended.

TITLE 26—INTERNAL REVENUE

Chapter I—Bureau of Internal Revenue

[T.D. 5139]

Subchapter C—Miscellaneous Excise Taxes

PART 178—PRODUCTION, FORTIFICATION, TAX PAYMENT, ETC., OF WINE

REGULATIONS NO. 7 AMENDED

1. The Act of April 8, 1942 (Public Law 519, 77th Congress), provides in part as follows:

That section 2901 of the Internal Revenue Code, as amended, is amended to read as follows:

SEC. 2901. *Loss Allowances.*

* * * * *

(b) *Loss.* The Commissioner of Internal Revenue may, under regulations to be prescribed by him and approved by the Secretary of the Treasury, abate any internal-revenue taxes accruing on distilled spirits if he shall find that—

* * * * *

(4) The distilled spirits were withdrawn for use in the fortification of sweet wines

Exhibit G

FINAL
WORK PLAN

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

FOR THE

LCP CHEMICALS, INC. SUPERFUND SITE LINDEN, NEW JERSEY

Prepared for:

ISP Environmental Services Inc.
1361 Alps Road
Wayne, New Jersey

Version
April 12, 2001

FINAL
WORK PLAN

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

FOR THE

LCP CHEMICALS, INC. SUPERFUND SITE LINDEN, NEW JERSEY

Prepared by:

URS Corporation
201 Willowbrook Boulevard
Wayne, New Jersey 07474

Version
April 12, 2001

WORK PLAN
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

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APPENDICES

This document is a Work Plan to conduct a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation and Feasibility Study at the LCP Chemicals, Inc. Superfund Site, in Linden, New Jersey. This Work Plan describes the history and physical characteristics of LCP Chemicals, Inc., the rationale for field investigation activities, the objectives of the activities, and the methods that will be used to conduct the Remedial Investigation (RI) and Feasibility Study (FS). This document is submitted on behalf of ISP Environmental Services Inc., in accordance with the requirements of the U.S. Environmental Protection Agency's (EPA) Administrative Order on Consent ("Consent Order"), Index No. II-CERCLA-02-99-2015, dated May 31, 1999.

1.1 SITE LOCATION

The LCP Chemicals, Inc. Superfund Site (the "site") is located in an industrial area at the foot of South Wood Avenue in Linden, Union County, New Jersey. The general site vicinity is known as Tremley Point. The site is centered at 40 degrees 36 minutes 29 seconds latitude and 74 degrees 12 minutes 41 seconds longitude on the United States Geological Survey Arthur Kill, N.Y./N.J. quadrangle map (Figure 1-1). The site encompasses about 26 acres and consists of the City of Linden Tax Block 587, Lot 3.01, Lot 3.02, and Lot 3.03.

The site is bounded to the north by ISP Environmental Services Inc. (inactive since 1991), to the northeast by Northville Industries' bulk petroleum storage area, to the southeast by the Mobil Gas bulk petroleum storage area, and to the south by the British Petroleum bulk petroleum storage area. A small, rechanneled tidal creek, South Branch Creek, flows eastward from the site and drains into the Arthur Kill.

As shown in Figure 1-1, the main Conrail line (Central Railroad of New Jersey) parallels the New Jersey Turnpike. A Conrail Spur (Sound Shore Branch) parallels the shoreline of Arthur Kill and crosses the site along Avenue B. A set of Conrail spurs, roughly parallel to Tremley Point Road, borders the southern part of the site. The Tremley Point Road spurs and the Sound Shore spur join at the southeast end of the site.

1.2 PROJECT OVERVIEW

The site consists of a former chlorine production plant and ancillary terminalling, packaging, and distribution areas. Between 1955 and 1982, the plant manufactured gaseous chlorine using a technology known as the mercury cell electrolysis process. A by-product of this process was wastewater and sludge that contained residual elemental mercury (a detailed discussion of site operations is presented in Section 1.4.2). Beginning in the early 1980s, both the EPA and the New Jersey Department of Environmental Protection (NJDEP) conducted numerous inspections and limited investigations at the site because of environmental concerns associated with the mercury cell process. The results of their investigations indicated that there were mercury releases at the site and to South Branch Creek, although the magnitude and extent of contamination were not determined. In 1985, LCP Chemicals, Inc. stopped their production activities and began to dismantle the facility. In 1995, a Resource Conservation and Recovery Act (RCRA) Facility Investigation Work Plan was prepared for the site (Eder, 1993) to evaluate potential contamination in areas of concern. The Work Plan was approved by the EPA on January 3, 1995 but it was not implemented because the owner of the site did not have the financial resources for remediation work. In 1996, the EPA evaluated the site for a Superfund Removal Action, but determined that there were no acute threats to human health and environment and that consequently, a short-term, emergency cleanup was not warranted. The EPA added the LCP Chemicals, Inc. site, a Division of Hanlin Group, Inc., to the National Priority List (NPL) on July 27, 1998 (which required that a CERCLA RI/FS be conducted for the site). In September 1998, the EPA identified GAF Chemicals Corporation as one of six potentially responsible parties (PRPs) for the site. The other five PRPs identified by the EPA were Caleb Brett (USA), Inc., Kuehne Chemical Company, Inc., Praxair, Inc., Union Carbide Corporation, and LCP Chemicals, Inc. (a division of the Hanlin Group, Inc.).

ISP Environmental Services Inc., which has assumed the liabilities of GAF Chemicals Corporation, executed the Consent Order with the EPA on May 31, 1999. This Remedial Investigation and Feasibility Study Work Plan describes the activities that will be conducted in accordance with the Consent Order. The proposed field investigation, however, is based on assumed site conditions, and a specific site activity, as described in Chapter 5.0, may not be appropriate once the actual conditions become known. Therefore, ISP reserves the right to modify the sampling or testing regime based on preliminary results or actual conditions encountered in the field. If major modifications to the RI/FS work scope described in this document become necessary, they will be submitted to the EPA in the form of a Technical Memorandum or other form of communication and the proposed modifications will not be implemented in the field without EPA approval. This Work Plan also acknowledges that the project objectives discussed below may not be completely fulfilled upon completion of the specific activities described in this document and that additional site investigations may be required before a remedy can be selected.

1.3 PROJECT OBJECTIVES

The environmental concern at the site is the potential for contamination resulting from mercury-bearing wastes that were generated, stored, or disposed of at the site for a period of about 25 years. Other sources of contamination, such as electric transformers that contained oils with polychlorinated biphenyls (PCBs) and former drum storage areas may also have contributed to site contamination.

The overall objective of the remedial investigation is to identify the nature and extent of contamination that may pose risks to human health and environment and to evaluate proposed remedies for the site. The objective of the feasibility study is to methodically select the most appropriate remedy, on the basis of several factors such as land use, effectiveness, and cost, that will be protective of human health and environment.

1.4 SITE BACKGROUND

This section presents the background history of the site.

1.4.1 Site Ownership

The Grasselli Chemical Company began industrial operations in the vicinity of the site around 1885. Before then, the area was undeveloped marshland. In 1924, the company became the Grasselli Dyestuff Company. It was incorporated in 1929 as American I.G. Chemical Corporation, which was owned by the German company I.G. Farbenindustrie, A.G. In 1939, the company changed its name to General Aniline & Film Corporation. In 1942, 98 percent of the company stock was seized by the United States Justice Department as a war asset and the company was operated by the U. S. Government acting as Alien Property Custodian. The chlorine plant was constructed at the site sometime around 1955; the site was generally undeveloped marshland up until that time. In 1965, the U.S. Government sold the stock in a public offering and in 1968, General Aniline & Film Corporation changed its name to GAF Corporation. In 1971, GAF Corporation shut down the chlorine production plant (the site).

In 1972, GAF Corporation (GAF) sold the plant to Linden Chlorine Products, Inc. of Edison, New Jersey. The company was founded by former GAF employees and formed solely for the reopening and operation of the Linden chlorine plant. In 1975, Linden Chlorine Products, Inc. reported that they owned no other facilities and that they produced only three products - chlorine, sodium hydroxide, and hydrogen.

By the early 1980s, as the company acquired additional chlorine production facilities along the U.S. east coast, Linden Chlorine Products, Inc. became LCP Chemicals-New Jersey, Inc., a subsidiary of Linden Chemicals & Plastics, Inc. Between 1987 and 1989, the company name was changed to LCP Chemicals-New Jersey, a division of Hanlin Group, Inc. On July 10, 1991, Hanlin Group, Inc. filed for bankruptcy under Chapter 11 of the United States Bankruptcy Code and sold all of its operating assets before April 1994. In August 1994, the EPA conducted a site visit and confirmed that the chlorine process buildings were decommissioned, the facility was no longer functional, and that the site was vacated by LCP employees. Active Water Jet, Inc., a pipe cleaning company, who was a tenant at the site since about the early 1990s, remains as the only current tenant at the site. Other former site tenants are described later in this chapter.

1.4.2 Site Operations

At the time of LCP Chemicals, Inc.'s mercury cell chlorine production, there were three main operating centers at the site - the mercury cell chlorine process area, the hydrogen gas processing plant, and the sodium hypochlorite manufacturing area. Process materials were transported to and from the site by tank truck, tank railroad car, or by barge. The storage and distribution of chlorine and related products (including methylene chloride and potassium hydroxide) generally occurred throughout the site's history. The chlorine production operations, however, were subject to periodic shutdowns brought on by changing market demand. The chlorine and related operating centers are described below, following a general description of the mercury cell electrolysis process.

1.4.2.1 Mercury Cell Electrolysis Process

The mercury cell was an industrial system that split common salt to produce chlorine. In a typical mercury cell process, salt solution (brine) passes between a graphite anode and a mercury cathode to produce chlorine and sodium through electrolysis. The chlorine is packaged in gaseous or liquid form for additional processing or distribution. The sodium dissolves in the mercury and the sodium-mercury mixture is made to react with water to produce sodium hydroxide and hydrogen. The products generated from this process, including the spent brine, contain residual amounts of mercury.

1.4.2.2 Chlorine Process Area

At the former chlorine plant, salt, water, mercury, and electricity were the principal raw materials used in the chlorine production process. LCP Chemicals, Inc.'s procedure for mercury handling and storage is not documented. Rock salt (or later evaporated salt) was transported to the site by rail, stored in the salt silos by Building 233 (Figure 1-2), and fed to the adjacent saturators to create brine. The brine was treated and filtered in a brine treatment tank in Building 233. The treatment consisted of adding chemicals such as sodium hydroxide, sodium carbonate, and barium chloride to precipitate impurities like calcium carbonate, sulfates, and hydroxides. This residual material is known as brine purification mud or brine "sludge". In the mid 1960s, a surface impoundment, the brine sludge lagoon, was constructed and used to dispose of the brine sludge and process wastewater. The sludge was mixed with brine and the resulting slurry was pumped to the brine sludge lagoon through overhead pipes. The supernatant, or the liquid content of the brine sludge lagoon, was pumped back to the brine purification tank for recycling and for redistribution either to the mercury cells or for slurry usage. Disposal practices for the brine sludge before the brine sludge lagoon was constructed are not documented.

After treatment, the purified brine was piped to the mercury cells in Building 230 and Building 240 to produce gaseous chlorine and a mercury-sodium mixture. The chlorine was cooled, dried (i.e., water vapor removed) with sulfuric acid, liquefied in Building 233, and stored in 100 ton vessels. The spent brine was recycled to the brine treatment tank in Building 233 for resaturation and to repeat the process.

The mercury-sodium mixture was piped to denuders, or strippers, where it was hydrolyzed to form elemental mercury, a sodium hydroxide solution, and gaseous hydrogen. The mercury was recovered and returned to the mercury cells. The sodium hydroxide solution was filtered and stored in above ground storage tanks at the northeast corner of the facility. Hydrogen gas was filtered in a commercial "Purasiv" unit south of Building 231 and piped to the hydrogen plant at the west end of the facility for packaging and distribution. On various occasions, the hydrogen gas was mixed with water and chlorine to form hydrochloric acid in both gaseous and liquid form. The hydrochloric acid was stored in tanks near Building 221. In March 1982, LCP Chemicals stopped the mercury cell process and brine sludge was no longer generated.

Between 1985 and 1994, the site was used as a transfer terminal for products made at other Hanlin Group Facilities. Products including potassium hydroxide, sodium hydroxide, hydrochloric acid, and methylene chloride were shipped to the site by rail or by truck, stored in above ground tanks, repackaged, and distributed. The Hanlin Group sold all of its operating assets by April 1994.

1.4.2.3 Linde Hydrogen Plant

The hydrogen plant, formerly known as Linde Gasses, occupied about 2.1 acres at the west end of the site (Figure 1-2). In 1957, Union Carbide Corporation (UCC) leased the hydrogen plant from GAF and operated it through 1990. Hydrogen was distributed from the mercury cells to the plant through overhead pipes. The gas was purified by UCC to remove entrained mercury (reportedly, up to five pounds of mercury was removed from the gas stream daily), stored, compressed, and shipped for distribution by trailer. This process continued through LCP Chemicals, Inc.'s 1972 purchase of the site from GAF. The hydrogen plant stopped utilizing the hydrogen generated by chlorine plant in 1980 and began packaging liquid cryogenic hydrogen that was brought to the plant from outside sources.

In 1988, in preparation of a new tenant, UCC had the building interior and hydrogen compressors decontaminated for mercury and collected wipe samples to confirm that the cleanup was effective (IT, April 22, 1988). IT reportedly recovered about 30 pounds of free mercury from one compressor and its associated piping.

In May 1990, the Linde plant ceased operations after the UCC lease with LCP expired, which triggered the NJDEP's Environmental Cleanup Responsibility Act (ECRA). Because several areas of environmental concern unrelated to the chlorine manufacturing process were noted at the plant (former underground storage tanks, sumps, septic tanks, etc.), ECRA required that a soil and groundwater investigation be conducted within the general boundaries of the 2.1 acre site.

An environmental investigation and cleanup took place in the early 1990s and the NJDEP approved no further action for the hydrogen facility on June 20, 1995.

The Linde Gas Facility was apparently last used in October 1994 by Liquid Carbonic Corporation, which was later purchased by Praxair, Inc. Liquid Carbonic rented the Linde Gas site from LCP Chemicals, Inc. and used it for office space and as a parking area for truck trailers. Liquid Carbonic Corporation ended its lease with LCP Chemicals, Inc. in March 1996.

1.4.2.4 Hypochlorite Facility

In 1972, Kuehne Chemical, Inc. participated in the formation of LCP Chemicals, Inc. Kuehne leased Lot 3.02, Lot 3.03, and the northern part of Lot 3.01 from LCP Chemicals, Inc. and started a sodium hydroxide manufacturing process. The processing area, located north of Building 220 and between Avenue C and Avenue D, consisted of above ground storage tanks, loading areas, and support buildings (Figure 1-2). Kuehne obtained the raw materials - chlorine and sodium hydroxide, by overhead pipes from the chlorine plant and blended the chemicals to make sodium hypochlorite (bleach). Chlorine, sodium hydroxide, hydrochloric acid, and sodium hypochlorite were also stored and distributed by Kuehne. Kuehne vacated the site in February 1981.

1.4.3 Site History

Much of the historic information presented in this report is compiled from numerous documents dating back to 1975 and earlier. Within these documents are numerous contradictions concerning the past operations of the site. This problem is compounded by the fact that much of LCP Chemicals, Inc.'s records were lost or destroyed sometime in the early 1980s (Eder, September 1993). Every attempt was made to reconcile these differences through evaluations of supporting evidence such as historic maps, deed records, and aerial photographs. Appendix A presents a timeline that summarizes some of the key milestones that occurred at the site, lists the supporting references, and provides a qualitative assessment of the reliability of data. The historic information presented in this document is based on this timeline, which will likely require updates if, and when, additional sources of information becomes available.

In 1870, all of Tremley Point was undeveloped marshland. By 1903, the tracks of the Sound Shore railroad were present, indicating that backfilling of low areas at the site had begun by that time. In 1923, the Grasselli Chemical Company was operating a large facility on the east side of the tracks north of South Branch Creek. The property on the west side of the tracks was vacant. By May 1929, the core buildings of the GAF Facility were present, but the LCP Chemicals, Inc., site was not developed. The property south of GAF's Building 1 (about 550 feet north of the northern LCP site boundary) was undeveloped and dissected with man-made drainage channels.

In 1940, the northern portion of the LCP Chemicals, Inc. site was still undeveloped marshland, with the exception of the presence of the Sound Shore Railroad tracks and the Central Railroad tracks along Tremley Point Road. The British Petroleum tank farm was present (15 tanks). By July 1947, the GAF Facility had expanded southward to South Branch Creek. GAF's Building 204 (Figure 1-2) was present at the northern edge of the site and northern part of the LCP site (just north of Building 220) was used as a laydown area for coal piles, tanks, and drums. Part of South Branch Creek was already filled in.

GAF began the chlorine operation at the LCP site in 1955 and by 1956, the core buildings of the chlorine facility were present, including Building 220 and Building 230. The hydrogen processing facility was constructed by 1959 and GAF leased 2.1 acres of the site to Union Carbide for hydrogen processing. The Brine Sludge Lagoon was reportedly constructed in 1962 and by 1966, berms were present along the north and west side of the lagoon area. The chlorine process waste was reportedly treated in a former wastewater treatment unit before this time. The former wastewater treatment unit system is described in Section 1.6. By 1966, South Branch Creek was filled west of Avenue B and the site drainage was provided by a flume and storm ditch system.

In 1971, GAF ceased chlorine operations and in 1972, LCP Chemicals, Inc. purchased the site from GAF and restarted operations. Between 1968 and 1972, the portion of South Branch Creek east of Avenue B was rechanneled to a location about 750 feet to the south and mercury cell Building No. 240 was constructed.

In 1972, LCP Chemicals, Inc. leased the northern part of the site to Kuehne Chemical Company to operate the sodium hypochlorite facility. In October 1972 and February 1974, the NJDEP reportedly observed lagoon overflows to South Branch Creek, but the quantities and responses are not known. LCP Chemicals, Inc. acknowledged both discharges in September 1975 and was levied a fine by NJDEP of $5,000 for each occurrence (NJDEP, July 1991).

By 1975, LCP Chemicals, Inc. was cooperating with the NJDEP and held meetings to investigate waste disposal options for brine sludge, wastewater, and the estimated 11,000 cubic yards of sludge material stockpiled in the brine sludge lagoon. LCP Chemicals, Inc. informed the NJDEP that off-site disposal options were too expensive and elected to begin pilot testing of a more cost-effective stabilization process developed by Chemfix Technologies, Inc.

LCP Chemicals, Inc. constructed an auxiliary surface impoundment, the Chemfix lagoon, and treated about 120,000 gallons (or about 460 cubic yards) of brine sludge using the Chemfix process. The Chemfix lagoon was used for a period of 4 days in 1976; the effectiveness of the operation was apparently questionable and LCP Chemicals, Inc. never continued with the Chemfix process.

LCP Chemicals, Inc. turned to using a proprietary sludge roasting process which would volatilize and capture mercury from steam dried brine sludge; they received favorable results during laboratory bench testing. A pilot sludge roaster unit was constructed south of the brine sludge lagoon in 1978 but the brine sludge material was processed through it only infrequently as the unit required constant "debugging", modification, and repair. By 1980, the final modifications to the sludge roaster were completed and the unit was brought back on line after LCP Chemicals, Inc. was issued a temporary air permit from the NJDEP. In December 1980, LCP Chemicals, Inc. and the NJDEP agreed that the brine sludge lagoon required closure and agreed to formalize the process through an Administrative Consent Order.

In March 1980, the Linde hydrogen plant stopped accepting hydrogen from LCP Chemicals, Inc. because of excess mercury contamination in the gas. In early 1981, Kuehne Chemical was cited by the NJDEP for caustic discharges, allegedly deliberate, into South Branch Creek, and Kuehne vacated the site shortly thereafter. The NJDEP entered into the Consent Order with LCP Chemicals, Inc. in September 1981 which required that, among other items, no more waste be placed in the brine sludge lagoon, a closure plan be developed and submitted for NJDEP approval, and a groundwater investigation be conducted. In November 1981, LCP Chemicals, Inc., abandoned the sludge roaster process because of equipment problems and stopped the generation of brine sludge in March 1982.

In 1982, LCP Chemicals, Inc. ceased plant operations, reportedly at the orders of the NJDEP and EPA, during the lagoon closure work to be protective of plant worker health and safety. The Chemfix lagoon was closed in 1983 (the Chemfix material was transferred to the brine sludge lagoon), and the brine sludge lagoon was closed by November 1984 with NJDEP approval. The lagoon closure consisted of dewatering, compaction, the addition of a two-ft thick clay cap, the addition of soil cover, and seeding. In June 1984, LCP submitted a facility closure plan to the NJDEP to close the production areas because of economic reasons. The EPA (1984) stated that LCP Chemicals, Inc. had planned to return to full chlorine-manufacturing operations in mid July 1984, but they instead ceased all plant production operations by August 1985. The facility began to be dismantled and the equipment was shipped to other LCP facilities along the east coast. Beginning in 1985, the facility was used only as a storage and transfer station for chlorine-related products produced by other LCP facilities, such as sodium hydroxide, potassium hydroxide, methylene chloride, and hydrochloric acid.

In July 1991, the Hanlin Group, Inc. filed under chapter 11 of the U.S. bankruptcy code and by April 1994, Hanlin sold all of its nation wide operating assets and all its chlorine manufacturing ceased. The EPA conducted a site visit in August 1994 and confirmed that the facility was no longer functional and that the employees were expected off the site by the end of August 1994. On November 10, 1998, the site property was formally abandoned by the New Jersey Bankruptcy Court.

1.4.4 Site Layout

The site is in a rough shape of a rectangle with two long, narrow arms extending to the southeast (Figure 1-2). The northern arm borders the course of South Branch Creek to Arthur Kill and the southern arm borders the railroad spurs of the Central Railroad of New Jersey for a distance of about 800 feet south.

Avenue B, Avenue C, and Avenue D extend roughly north to south across the site (Figure 1-2). South Branch Creek, the former Chemfix lagoon, the former brine sludge roasting unit, and the closed brine sludge lagoon are east of Avenue B.

The channel to South Branch Creek extends from Arthur Kill westward and ends at the railroad tracks between Avenue B and Avenue C (the original channel was relocated between 1968 and 1972). A wooden flume formerly connected to the creek at this point, extended northward along Avenue C, then extended westward along the northern boundary of the site across Avenue D and connected into the ditch system of the GAF site. The flume system is currently backfilled.

Above ground storage tanks (currently empty) used for sodium hydroxide, chlorine, and brine are located between Avenue B and Avenue C. The chlorine liquefaction and compressor building (Building 231), the former hydrogen filtering unit (Purasiv unit), and the wastewater metering sump are also here. An effluent treatment building was also located just south of the surface water flume to South Branch Creek.

The chlorine and hypochlorite processing areas and the brine treatment area were located between Avenue C and Avenue D in the central part of the site. The north central area consisted of the former hypochlorite processing area, which included a chlorine truck-loading area, a laboratory and locker building (Building 221), and Building 223 (usage unknown). The mid-central area contains the cell buildings (Building 230 and Building 240), the shop and service building (Building 220), and the chlorine cooling and drying building (southern part of Building 240). The south central portion contains the former salt storage tanks, the saturators, the brine storage tanks and the brine processing building (Building 223).

The site is mostly vacant west of Avenue D. This area contains the area of the former hydrogen plant and an existing electrical switchyard. Much of the area was used for employee parking.

1.5 SOLID AND HAZARDOUS WASTE GENERATION

The wastes generated at the site included mercury contaminated sludge, mercury vapors, spent lubricating oils, transformer oils, degreasing solvents, mercury contaminated process wastewater, spill wash down fluids, and stormwater runoff (Eder, January 1992).

Brine purification mud (brine sludge) and associated process wastewater were the principal wastes generated at the site. In 1981, the EPA listed brine purification mud from the mercury cell process as hazardous waste No. K071 and associated wastewater treatment sludge as hazardous waste No. K106. The mercury content of these materials is the basis for listing the material as hazardous.

A "typical" brine sludge composition was reported by LCP Chemicals, Inc. (1975) as NaCl (20%), BaSO4 (50%), CaCO3 (15%), CaSO4 (15%), metal hydroxides (2%), dirt (2%), mercury (100-500 parts per million - 0.05%). Wastewater treatment sludge was also generated during chlorine production. In their 1975 Preliminary Report on Brine Sludge, LCP Chemicals, Inc. reported that an estimated 7.5 tons of sludge was generated every day and that their current stockpile of sludge was an estimated 11,000 cubic yards. Eder (1992) reported that up to 20 tons of sludge were generated per day.

Seven sludge samples were analyzed for selected inorganic constituents between 1980 and 1981 (NJDEP, January 8, 1988). The analyses showed that the sludge contained mercury with concentrations ranging between 272 mg/kg and 4,576 mg/kg. Liquids filtered from the sludge contained mercury at concentrations ranging between 40 ug/l and 2,520 ug/l.

Waste disposal practices for the chlorine plant before construction of the brine sludge lagoon are poorly documented. GAF reportedly used a small pond as a wastewater treatment unit for disposal. The wastewater was pH neutralized, filtered though a carbon unit at the north end of the site, and discharged into South Branch Creek. The location of the discharge point into South Branch Creek is not documented.

A survey plan in a report by Geraghty & Miller (1982) shows that the brine sludge pile grew to a height of about 40 above the ground surface. An estimated 31,000 cubic yards of brine sludge was left in the lagoon at the time of closure. The material in the lagoon was dewatered, graded, compacted, and capped with a clay cover in 1984.

Other sources of potential sources of contamination included:

- Kuehne Chemical Company, which operated at the site from 1972 to 1981, allegedly dumped bleaches and other caustic material into South Branch Creek on a daily basis.

- The Linde Hydrogen Plant, which received mercury-contaminated hydrogen gas from about 1957 to 1980, processed mercury on a daily basis.

- Eder (September 1993) reported that small quantities of solvents used at the site for general cleaning and degreasing could also potentially have been released to the environment.

- Transformers were located behind Building 230 and Building 240, and on the north side of Building 231. The transformers may have contained oil with PCBs.

- Storage tanks at the site were used to store chlorine, sodium hypochlorite, sodium hydroxide, and methylene chloride (NJDEP, January 8, 1988).

- A 300 square-foot concrete drum storage pad with containment berms was located at the south central edge of the site. The pad was used to store drums of motor oil, waste oil, and other lubricants (Eder, 1993). During their December 22, 1987 inspection, the NJDEP noted stained soils and detected organic vapors around the pad.

1.6 WASTEWATER AND SURFACE WATER HANDLING

Before 1972, wastewater generated by cell washdown and cell maintenance was reportedly processed in a former pond, located east of the electrical switchyard (Eder, January 1992). The pond was originally part of the channel of South Branch Creek (Eckenfelder, September 1989). The wastewater was pH neutralized, filtered though a carbon unit at the north end of the site, and discharged to South Branch Creek. Eder (January 1992) stated that in the mid 1970s, the former wastewater treatment unit was reportedly excavated, backfilled, and covered with asphalt. The treatment unit was still present in mid 1972 (LCP, July 21, 1972) and possibly only backfilled in 1982 (NJDEP, February 1982).

Plant wastewater and sludge were collected in a 500,000 gallon (500K) agitating collection tank and the slurry was piped to Silo No. 4. The supernatant was directed to the effluent treatment system and the settled solids were directed to the brine sludge lagoon, or later, to a 4,500 gallon surge tank at the sludge roaster unit (NJDEP, January 8, 1988).

Storm water runoff at the site collected in a continuous concrete drainage swale/trench that surrounded the process area and was routed to a concrete sump south of Building 231. The runoff was pumped to holding tanks outside Brine Building 233, pH adjusted, filtered, polished with carbon, and stored pending annual or semiannual discharge to South Branch Creek in accordance with their New Jersey Pollutant Discharge Elimination System (NJPDES) permit. The system in Brine Building 233 was operational since the early 1980s.

Process wastewater in the mercury cell buildings drained to concrete floor trenches, collected in sumps in the northeast corner of each cell building, pumped to holding tanks, and eventually pumped to the wastewater treatment system.

1.7 PERMITS

A summary of the permits that were issued to LCP Chemicals, Inc. is presented in Table 1-1. The first reference to Permit No. NJ0003778, the discharge to surface water permit, was made in June 1975, when the facility reported to the EPA that an accidental release of brine sludge to South Branch Creek occurred for an estimated nine-hour period. The conditions of that permit were not described.

The NJDEP reissued the Permit in 1987 and required that LCP Chemicals, Inc. install four new monitoring wells to evaluate the groundwater quality in the water table aquifer.

Kuehne Chemical Company submitted a National Pollutant Discharge Elimination System (NPDES) permit application, Application No. 0027707, on August 27, 1974. In August 1980, the EPA issued the NPDES permit for the discharge of uncontaminated cooling water only from the sodium hypochlorite process. In 1981, the NJDEP alleged that Kuehne Chemical Company was dumping caustic material into the outfall and issued a Notice of Civil Administrative Penalty Assessment against the company on October 7, 1981. The notice states that a pipe was observed during an NJDEP site visit on January 26, 1981 "connected to the outfall in such a manner as to allow for a physical conduit for the passage of pollutants to the waters of the State". This connection was removed at the time of a follow up visit by the NJDEP on the next day. The notice also states that Kuehne Chemical Company ceased operations and vacated the site that same day.

1.8 REGULATORY VIOLATIONS, ACTIONS, AND INVESTIGATIONS

The section summarizes the regulatory history of the LCP Chemicals, Inc. site.

1.8.1 Summary of Incidents and Enforcement Actions

The NJDEP (July 1991) states that in September 1975, LCP Chemicals, Inc. was fined $10,000 for discharges of supernatant from the brine sludge lagoon to South Branch Creek in October 1971 and February 1974. Details of the discharges are not known.

On September 17, 1981 the NJDEP signed an Administrative Consent Order, dated September 17, 1981 requiring that LCP Chemicals, Inc. perform the following tasks:

- Cease use of the Brine Sludge Lagoon by January 1, 1982;
- Submit a closure plan for the Brine Sludge Lagoon;
- Submit a closure plan for the Chemfix Lagoon;
- Conduct air monitoring of the brine sludge pile; and
- Conduct a soil, sediment, surface water, and groundwater sampling program.

LCP Chemicals, Inc. responded to the requirements of the order and both lagoons were formally closed by November 1984, air monitoring of the sludge pile took place on June 4, 1981 (RECON, 1981), and a limited soil, sediment, surface water, and groundwater investigation was performed by Geraghty and Miller (1982). The results of the investigation are briefly summarized in Section 1.10.4.

The NJDEP issued an Order dated May 4, 1982 to cease the November 5, 1981 violation of N.J.A.C. 27-8.3(e)2 resulting from a ruptured muffler plate on the brine sludge roaster allowing mercury emissions to vent directly to the atmosphere from the operation of four unpermitted propane burners on the unit (Eder, January 1992). LCP Chemicals, Inc., however, abandoned the sludge roaster experiment because of equipment problems and had stopped roaster operations in November 1981.

In a letter dated June 4, 1982, the NJDEP denied LCP Chemicals, Inc.'s Hazardous Waste Facility Permit Application because of the severe deficiencies of the sludge roasting system and the inability to process the waste on site. LCP Chemicals, Inc. (June 29, 1982) responded in a letter to the NJDEP that they planned to modify the roaster design to correct these deficiencies. LCP Chemicals, Inc. continued with the lagoon closures and began to dispose of its waste off site.

The EPA issued a Complaint/Compliance Order dated August 25, 1982 for lack of freeboard in a surface impoundment (brine sludge lagoon). LCP Chemicals, Inc. was also cited for lack of a waste analysis plan, not maintaining a schedule of inspections, and lack of a contingency plan. LCP Chemicals, Inc. (August 10, 1984) reported that they were fined $1,000 for the freeboard violation and corrected the other violations with no penalty assessment.

The NJDEP issued a Notice of Violation dated January 7, 1983 for failure to submit a RCRA Treatment, Storage, or Disposal Facility annual report. An annual report was submitted to the NJDEP shortly thereafter on January 17, 1983 and no penalty was assessed.

The NJDEP issued a Notice of Violation dated November 16, 1983 for failure to establish financial assurance for closure and post-closure monitoring of the brine sludge lagoon and to demonstrate financial responsibility for claims. LCP Chemicals, Inc. responded (August 10, 1984) that it was their understanding that the NJDEP Division of Waste Management now had copies of the necessary documents and that the matter was now resolved.

The NJDEP issued an Administrative Order, dated February 11, 1985, requiring that LCP Chemicals, Inc. maintain documentation of the job title for each position at the facility related to hazardous waste management, the name of the employee filling each job, keep a roll-off container with hazardous waste material secure, provide immediate access to telephones and alarm systems within hazardous waste areas of the facility, and to develop an evacuation procedure for employees. LCP Chemicals, Inc. corrected the deficiencies and was assessed a penalty of $900.

1.8.2 Summary of Spills and Releases

Several spills and releases at the site were documented by the NJDEP and the EPA. These incidents are briefly described below.

1.8.2.1 South Branch Creek

October 30, 1972 - A release occurred from the brine sludge lagoon - location and quantities unknown (NJDEP, July 1991).

February 7, 1974 - A release occurred from the brine sludge lagoon - location and quantities unknown (NJDEP, July 1991). LCP Chemicals, Inc. acknowledged both releases on September 25, 1975 and was fined a total of $10,000.

June 25, 1975 - A nine hour discharge of the contents of the brine sludge lagoon into South Branch Creek occurred when a recycling pump failed (LCP, July 27, 1975).

August 15, 1979 - An estimated 10,000 to 20,000 gallons of mercury-contaminated brine overflowed a saturator for an 8-hour period when it became blocked with salt. The brine discharged into South Branch Creek (LCP, August 20, 1979). A sample from the spill was analyzed by LCP Chemicals, Inc. for mercury and showed a concentration of 8.6 parts per million.

In January 1981, a former employee who worked at the site between 1972 and 1980 stated that he sometimes performed laboratory analyses on the effluent water that was being discharged into South Branch Creek (NJDEP, January 25, 1981). On one occasion, he detected mercury concentrations eight to ten times greater that the maximum allowed (the concentrations were not specified). The employee alleged that his supervisor told him to destroy the results, which he did.

October 7, 1981- Kuehne Chemical Company was cited by the NJDEP for discharging caustic material into South Branch Creek (NJDEP, October 7, 1981). Kuehne Chemical Company contested the NJDEP's action and subpoenaed the NJDEP on October 27, 1981 for depositions. The outcome of this dispute is unknown.

1.8.2.2 500,000 Gallon (500K) Tank

Several releases were documented by the NJDEP near the 500,000 gallon (500K) brine tank. The NJDEP Site Inspection Reports can be found in the RCRA Facility Assessment for LCP Chemicals - New Jersey (NJDEP, January 8, 1988).

On September 17, 1980, an unspecified amount of brine sludge was noted on the gravel near the 500K tank.

On October 9, 1980, brine sludge was transferred from the 500K tank to the brine sludge lagoon by front end loader and dump truck. During the transfer process, some sludge had fallen to the ground. LCP told the NJDEP that the spilled sludge would be flushed into the sump next to the 500K tank.

On January 22, 1981, a leak was observed in an overhead pipe north of the 500K tank. Wash water from the cell rooms spilled onto the unpaved ground. The NJDEP was informed that repairs would be made.

On October 22, 1981, a 10 ft by 4 ft hydrochloric acid spill resulting from a leaking overhead pipe was observed about 15 ft northwest of the 500K tank.

On April 13, 1982, a spill of sodium sulfide crystals was observed just north of the 500K tank.

1.8.2.3 Releases Near the Brine Sludge Lagoon

NJDEP Site Inspection reports document releases of brine sludge from leaks from the overhead pipes leading from Building 233 to the brine sludge lagoon. The NJDEP Site Inspection Reports can be found in the RCRA Facility Assessment for LCP Chemicals - New Jersey (NJDEP, January 8, 1988).

On October 22, 1981, a 1 ft by 15 ft spill of brine sludge slurry resulted from a leaking overhead transfer line between the 500K tank and the brine sludge lagoon. The spill occurred on Avenue B, between the railroad tracks and the brine sludge lagoon. The exact location of the overhead line is not well documented, but NJDEP sketch maps (e.g., NJDEP, November 19, 1981) indicate that it extended from the 500K Tank/Building 233 area to the southwest corner of the brine sludge lagoon.

On November 19, 1981, the overhead line was again leaking, which resulted in a 30 ft by 125 ft spill along the Avenue B railroad tracks.

In January 1981, a former employee who worked at the site between 1972 and 1980 stated that sometime in 1973 or 1974, brine sludge was removed from the brine sludge lagoon and the material was spread out on the ground between Building 231 and the railroad tracks (NJDEP, January 25, 1981). To his knowledge, this occurred on only one occasion.

1.9 PHYSICAL SETTING

The general physical setting of the LCP Chemicals, Inc. site is presented in this section.

1.9.1 Topography and Drainage

The site is relatively flat, with the exception of the former brine sludge lagoon, at an elevation of about 8 feet above mean sea level (Figure 1-1). The former brine sludge lagoon has a footprint of about 150 ft by 250 ft and it reaches a height of about 15 ft above grade. The mound is vegetated, although several shallow erosion gullies are present along the flanks.

The 100-year flood elevation for the Linden, New Jersey area is estimated to be about 9 ft mean sea level (Eckenfelder, 1991) and therefore, most of the site is located within a 100-year flood zone. A map showing the site in relation to the 100 year and 500 year flood plain is shown in Appendix B.

Storm water runoff at the site collects in drainage swales that surrounded the process area and routes to a concrete sump south of Building 231. The runoff is reportedly periodically pumped into holding tanks outside Building 233, pH adjusted, filtered, polished with carbon, and stored pending annual or semiannual discharge to South Branch.

1.9.2 Geology

The geology across the site is defined only in a few locations. Subsurface data east of Avenue B were collected from borings that were advanced to bedrock immediately around the brine sludge lagoon (Geraghty & Miller, February 1982). The following four stratigraphic units are identified in the area around the former brine sludge lagoon (Figure 1-3):

- Fill Unit - industrial fill and imported sands (5-10 ft thick)
- Tidal Marsh Deposits - dark gray organic clay (10 ft thick)
- Till Unit - red brown silt and clay , +/- red-brown weathered shale (20-30 ft thick)
- Bedrock - siltstone and shale of the Passaic Formation.

<u>Fill Unit</u> - the Fill Unit is a heterogeneous mixture of silt to gravel-sized particles containing industrial material including slag, crushed stone, and brick. On the basis of its geographic location (i.e., in lowlands), date of deposition (beginning in the late 1920s), and composition, this material likely meets the definition of "Historic Fill", as defined by the NJDEP in N.J.A.C. 7:26E-1.8.

<u>Tidal Marsh Deposits</u> - This unit consists of dark gray clay with organic matter and tidal grasses, with occasional layers of peat and silt. A subunit of organic silty sand with shells was also identified.

<u>Till Unit</u> - This unit consists of reddish brown clay, silt, sandy silt, and gravel. Some of this material, at depths close to bedrock, is derived from the weathering of bedrock.

<u>Bedrock</u> - Bedrock consists of the reddish brown shale and siltstone of the Passaic Formation of the Newark Supergroup.

This same stratigraphic package was also identified immediately north of the site at the GAF Chemicals Corporation facility (hereafter called the ISP Environmental Services Inc. site) by Eckenfelder (1991).

The subsurface geology west of Avenue B was never investigated in detail. During the ECRA investigation of the Linde Hydrogen Plant, eight borings were advanced, but only to depths of about 15 feet (IT, 1991). IT identified the material underlying the 2.1 acre site, from top to bottom, as 8 feet of fill, consisting of black cinders, black sand, and pieces of rock and gravel, and an undetermined thickness of gray clay, peat, and red and gray silt (Tidal Marsh Deposit). The Tidal Marsh Deposit was apparently not completely penetrated at the former hydrogen plant.

1.9.3 Hydrogeology

The groundwater characteristics of the site are not well defined. On a regional scale, the groundwater flow direction is inferred to be predominately eastward toward Arthur Kill. Data from previous investigations indicate that the water table is between 3 and 6 feet below the ground surface with an elevation of approximately 5 to 6 feet above mean sea level.

Geraghty & Miller (1982) installed six monitoring wells (MW-1, MW-1A, and MW-2 through MW-5) around the former brine sludge lagoon. The length of the well screens varied from 5 ft to 30 ft (Table 1-2) and the screens were set at different depths and within different stratigraphic units (Figure 1-3). As such, these wells are considered suspect for any evaluation of contamination and the groundwater elevation data from these wells are not useful to identify groundwater gradients and flow directions. Permeability tests and the evaluation of tidal influences on these wells were apparently never conducted.

Eder installed four shallow groundwater wells in 1990 (MW-6 through MW-9) with screens set across the water table (Figure 1-2), but did not report groundwater elevations, flow directions, or possible tidal influences on groundwater (Eder, January 1992; September, 1993).

In the west portion of the site, IT Corporation installed 8 shallow monitoring wells between 1991 and 1992 (MW-1 through MW-8; herein called IT-MW-1 through IT-MW-8) around the Linde hydrogen plant (Figure 1-2) as part of an ECRA investigation (IT, May 1992). On the basis of data collected during two rounds of water level measurements, IT reported that the groundwater flow direction was south to southwest toward the Rahway River (Figure 1-1). Groundwater data can no longer be collected from these wells because they were sealed, with NJDEP approval, on October 13, 1993 in response to the NJDEP's no further action decision for the hydrogen plant (IT, June 1994).

Eckenfelder (1991) reports that the shallow groundwater flow direction in the northwestern portion of the site is to the north based on work conducted on the neighboring ISP Environmental Services Inc. Site.

An evaluation of the available historic boring and monitoring well data (Table 1-2) allows several inferences to be made about groundwater at the site. Data from monitoring well pair MW-1 and MW-1A (Figure 1-3) suggests that a potential downward vertical gradient exists between the upper and deeper water-bearing zones, although the transient effects of tides on site groundwater have not been investigated in detail. The water table appears to occur within the fill unit (see Eder and IT data in Table 1-2) just above the Tidal Marsh Deposit. The Tidal Marsh deposit may be locally acting as a confining layer to infiltrating precipitation which could cause the local groundwater to exist under perched conditions. A substantial saturated thickness is not present above the TMD. The historic data shown in Table 1-2 suggest that only an average of 2 to 3 ft of water is present above the TMD. This conceptual geologic and hydrogeologic model of the site will be further evaluated during this RI.

1.9.4 Wetlands

Malcolm Pirnie (1995), as an EPA Contractor, conducted a wetland delineation survey in 1995 along South Branch Creek using 1989 U.S. Federal wetland determination criteria (EPA and others, January 1989). Malcolm Pirnie reported that a narrow corridor of wetlands existed along both banks of South Branch Creek for its entire length. Malcolm Pirnie estimated that about 2,300 lineal feet (0.43 miles) of wetlands frontage existed along South Creek basin and within the boundaries of the site, although the total acreage was not reported. The wetlands were classified as estuarine emergent wetlands. Malcolm Pirnie (1995) also reported that there are no terrestrial sensitive areas on or within 200 feet of the site property. Malcolm Pirnie's report of the wetland delineation survey is presented in Appendix C. Malcolm Pirnie's wetland delineation map is also included in Appendix C, although the delineation lines apparently were not reproducible from the original because the extent of wetlands in not visible on the map.

1.9.5 Surface Water

The center of the site is located within 1,500 feet of the Arthur Kill. Arthur Kill is a tidal channel that joins Newark Bay and Raritan Bay. Pralls Island is in the center of the Arthur Kill opposite the site.

South Branch Creek, a local tidal tributary of Arthur Kill, drains the site and discharges to the Arthur Kill. Originally, South Branch Creek flowed across the center of the site, roughly beneath the area where Building 230 now stands, and extended to the area now occupied by the former hydrogen plant. By 1947, the creek was beginning to be filled and diverted from its original channel west of Avenue B.

The course of South Branch Creek between Avenue B and Arthur Kill was altered sometime between 1968 and 1972. The original discharge point of the Creek was about 750 feet north of the current discharge point. By 1966, South Branch Creek was no longer present west of

Avenue B (Eckenfelder, 1989) and a system of wooden flumes and concrete trenches were installed to provide drainage west of Avenue B.

Arthur Kill is classified by the NJDEP as saline estuarine waters - SE3 (N.J.A.C. 7:9B) with designated usages of secondary contact recreation (i.e., boating, fishing, minimal ingestion), maintenance of wildlife, and maintenance and migration of the natural and established biota. The Rahway River is located about 1,500 south of the site. The Rahway River is classified as SE2 (N.J.A.C. 7:9B) which has similar uses as SE3 waters.

1.9.6 Tidal Data

Tidal influences on groundwater or South Branch Creek are not well defined. NUS (1984) states that there are 2 foot tides in South Branch Creek. High tide and low tide differences measured at the Rahway River Station (about 1 mile southwest of the site) average about 5 ft per cycle (Tide Tables, 1996). Tidal influences on Eder's shallow monitoring wells MW-6 through MW-9 have not been reported.

1.9.7 Land Use

The site is located between the Arthur Kill to the east, the New Jersey Turnpike to the west, and the Rahway River to the south. The area is mostly industrial. The only residential area within a mile radius is in the Tremley section of Linden, about 0.75 miles west of the site. The area immediately surrounding the site is zoned by the City of Linden as H-1, Heavy Industrial District. The permitted uses of this zone include manufacturing (with no chemical or raw material processing), research and laboratory offices, service stations, truck terminals, and tank farms. The zoning regulations do not currently allow residential development east of the New Jersey Turnpike (Eckenfelder, 1991).

Current land use is within an approximate 1-mile radius of the site is primarily industrial, with pockets of wooded wetlands, saline marshes, and surface water bodies (NJDEP, 1996). A map showing land use in the site vicinity is presented in Appendix B. The New Jersey Turnpike forms a major geographic boundary separating Tremley Point from the rest of the City of Linden, New Jersey.

1.9.8 Well Search

Potable water supplies in the vicinity of the site have been researched by Malcolm Pirnie (July 1995). Groundwater is not used as a source of drinking water within four miles of the site. Although the Passaic Formation is a state aquifer, there are no potable wells within four miles of the site. There are no designated or proposed Wellhead Protection Areas within four miles of the site. A preliminary compilation of Public-Community Water-Supply (PCWS) Wells conducted for New Jersey by the NJ Geological Survey (July, 1997) indicates that there are no PCWS wells within 3.5 miles of the site. A decision to update the well search for the site vicinity will be conducted after an evaluation of the hydrogeologic and groundwater quality data generated during the RI field investigation.

1.9.9 Ecological Resources

A Greenway project was initiated for the Arthur Kill as part of a response to a 1990 Bayway Refinery oil spill. Numerous salt marsh habitats were identified inside the Arthur Kill watershed area close to the site. The Peregrine Falcon, the northern harrier, the great blue heron, the yellow crowned night heron, and the little blue heron are reported to either breed or hunt in the surrounding marshes. A habitat restoration project was ongoing at Pralls Island as of 1996 to protect these NJ state-listed species. An ecological evaluation of South Branch Creek was apparently never performed. There are no terrestrial sensitive environments within 200 feet of the site (U.S. EPA, 1996).

1.9.10 Climate

The National Oceanic and Atmospheric Administration/Cooperative Institute for Research in Environmental Sciences Climate Diagnostics Center (April 2000) report the following climate data for the site area (Newark, NJ). From 1961 through 1990, the average monthly maximum temperatures range from 85.7 degrees Fahrenheit in July to 37.7 degrees Fahrenheit in January. Temperature extremes range from a high of 105 degrees Fahrenheit in July 1966 to a low of -8 degrees Fahrenheit in January 1985.

The 30-year normal annual precipitation (1961 through 1990) is 43.9 inches with its distribution relatively uniform throughout the year. The mean annual snowfall is 26.6 inches. Eckenfelder (1991) report that in the site area, the prevailing wind direction is from the southwest, west, and northwest. Relative humidity for the area averages about 73 percent in the morning to about 61 percent in the evening.

1.9.11 Aerial Photographs

A set of aerial photographs was compiled by Eckenfelder (1989) for the ISP Environmental Services Inc. site which borders the site to the north. An evaluation of the photographs, which include the LCP site, is presented in Appendix D. Reproductions of the aerial photographs from the years 1929, 1947, 1952, 1956, and 1967 are also included in Appendix D. The EPA (1999) also compiled an evaluation of aerial photographs of the site. The EPA evaluation was used to identify historic potential areas of concern such as areas of stained soil and areas of standing water (Section 1.11.15). Data from the EPA aerial photograph interpretation were used in the selection of proposed sampling locations, which is detailed in Section 5.0.

1.10 OVERVIEW OF PREVIOUS INSPECTIONS AND INVESTIGATIONS

Table 1-3 presents a summary of the regulatory site inspections and investigations conducted at the site. A brief discussion of those investigations which generated analytical data is presented below. This summary is not intended to provide detailed information on the nature and extent of site contamination because much of the analytical data generated to date is old, unsupported, and consequently suspect and unusable for site decisions. Some of the analytical results (such as data from filtered groundwater samples) are not plotted or tabulated in this report because the data has no regulatory value. The intent of this section is to present a broad overview of the previous investigations to provide a general historic perspective of the site.

To provide a point of reference for the discussion of the historical results, the current NJDEP cleanup criteria (May, 1999) for mercury, the primary constituent of concern, is presented. The NJDEP Residential Direct Contact Soil Cleanup Criterion for mercury is 14 mg/kg, the NJDEP Non Residential Direct Contact Soil Cleanup Criterion for mercury is 270 mg/kg, and the NJDEP groundwater criterion for mercury is 2 ug/l. New analytical data collected during this RI/FS will be compared against the current Applicable or Relevant and Appropriate Requirements, as required by CERCLA.

1.10.1 1978 NJ Department of Health Sampling

An aqueous sample was collected from the "leachating drainage ditch tributary to Arthur Kill" on May 31, 1978 (Table 1-4). The collector is unknown. The pH of the sample was 12, which represents caustic conditions. The exact location of the sample is not known.

1.10.2 1980 NJ Department of Health Sampling

A total of seven sediment samples (C05786, C05784, C05782, C05851, C05793, C05790, and C05788) were collected from South Branch Creek on August 12, 1980 for unspecified reasons. The collector is unknown and the locations of some samples can only be inferred because maps were not provided. The mercury concentrations of the samples ranged between 7.8 mg/kg to 87.7 mg/kg (Table 1-5). The current NJDEP sediment guidance screening value for mercury is 0.71 mg/kg (medium effect range for estuarine sediments). Figure 1-4 provides the inferred sediment sample locations and the analyte concentrations.

1.10.3 RECON Systems 1981 Sludge Pile Air Sampling

On June 4, 1981, RECON Systems, Inc. conducted real-time mercury air monitoring of the waste pile in the brine sludge lagoon. They estimated that the pile emitted an average 113 grams/day of mercury. They cautioned, however, that because of numerous atmospheric variables used to calculate the emission rate (e.g., temperature, wind speed, etc.), the results were valid for that day only. Mercury emissions at active chlorine production facilities currently cannot exceed 2,300 grams/day (EPA, 40 CFR Part 61).

1.10.4 1981 Geraghty & Miller Groundwater Investigation

The first formal investigation at the site occurred in 1981 with the installation of six monitoring wells around the brine sludge lagoon in September and October 1981 to comply with the NJDEP September 1981 Consent Order and with RCRA groundwater monitoring requirements. Geraghty & Miller (1982) installed one water table monitoring well (MW-1A) and five wells (MW-1 through MW-5) that were screened either below or across the Tidal Marsh Deposit (Figure 1-3). As previously stated, these wells are suspect for any data previously collected and will not be used in any future investigations.

Soil samples collected from the upper 10 feet (Fill Unit) of the monitoring well borings had mercury concentrations that ranged from 1.0 mg/kg to 772 mg/kg (Table 1-6). The concentration of mercury in soil decreased with depth, and generally decreased distinctly at the base of the fill layer (Figure 1-5). The soil data indicates that the screens for the Geraghty & Miller monitoring wells MW-1, MW-2, MW-3 and MW-4 were set below the depth of significant mercury contamination in soil.

The monitoring well network (MW-1, MW-1A, and MW-2 through MW-5) established by Geraghty & Miller (1982) is not effective in monitoring shallow groundwater quality around the brine sludge lagoon. The screens for these monitoring wells were set within different geologic horizons (described in Section 1.9.3 and shown in Figure 1-3) and, as described above, below the depth of mercury contamination in saturated soil. The groundwater data from these wells, according to the NJDEP, were not useful to support further action or no further action decisions for the site. In 1987, the NJDEP (January 1987) downgraded the status of these wells to piezometers and required that LCP Chemicals, Inc. install four new water table monitoring wells. The new wells were installed by Eder in 1990 (Figure 1-2).

Geraghty & Miller submitted two rounds of dissolved (filtered) groundwater samples to the site laboratory for mercury analysis in October 1981 and one round of groundwater samples to an independent laboratory in November 1981. The analytical results showed mercury concentrations of less than 1 ug/l.

Four surface soil samples (S-1 through S-4) and one sediment sample (GM-Sed) were collected by Geraghty & Miller and analyzed by the site laboratory. Mercury concentrations in the soil samples (Table 1-6 and Figure 1-6) ranged between 27 mg/kg and 1,580 mg/kg and the mercury concentration in the sediment sample was 46 mg/kg (Table 1-5 and Figure 1-4).

1.10.5 March 1982 Groundwater Samples to ETC laboratory

Filtered groundwater samples (MW-1, MW-2, MW-3, and MW-4) were collected on March 15, 1982 by LCP Chemicals, Inc. and submitted to ETC Laboratories for the analysis of selected metals, selected pesticides, one herbicide (silvex), radiological parameters, bacteria, and water quality parameters. Arsenic (10 ug/l) and cadmium (10 ug/l) exceeded the current NJDEP Groundwater Criteria of 8 ug/l and 4 ug/l, respectively.

1.10.6 1984 NUS Corporation Investigation

On September 27, 1984, NUS, as contractors for the EPA, collected three groundwater samples (GW-1 through GW-3), two surface soil samples (S-1 and S-2), and two sets of surface water/sediment samples (SW-1/SD-1 and SW-2/SD-2) from areas around the brine sludge lagoon. The samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals.

The three groundwater samples, designated by NUS as 3348-GW-1, 3348-GW-2, and 3348-GW-3, were collected from MW-2, MW-4, and MW-5, respectively. The samples contained concentrations of arsenic, chromium, and lead, that exceeded the current NJDEP groundwater standard of 8 ug/l, 100 ug/l, and 10 ug/l, respectively (Table 1-7). Mercury concentrations in MW-4 (253 ug/l) and MW-5 (116 ug/l) exceeded the current NJDEP mercury groundwater standard of 2.0 ug/l.

The two surface soil samples collected from east of the brine sludge lagoon (3348-S-1) and from the surface of the excavated Chemfix lagoon (3348-S-2) exceeded the NJDEP arsenic cleanup criterion of 20 mg/kg with concentrations of 26 mg/kg and 50 mg/kg, respectively (Table 1-6 and Figure 1-6). The mercury concentrations were 2.6 mg/kg and 53 mg/kg, respectively.

Surface water sample 3348-SW-1 was collected from the drainage flume and sample 3348-SW-2 was collected east of the brine sludge lagoon (Figure 1-7). Samples 3348-SW-1 and 3348-SW-2 contained mercury at concentrations of 20 ug/l and 212 ug/l, respectively (Table 1-4). Sediment collection points were collocated with the surface water samples (1-4). Sediment sample 3348-SD-1 contained arsenic at a concentration of 44 mg/kg and mercury at a concentration of 784 mg/kg. Sediment sample 3348-SD-2 contained arsenic at a concentration of 54 mg/kg (Table 1-5).

1.10.7 LCP 1987 Quarterly Groundwater Results

Four rounds of groundwater samples were collected from monitoring wells MW-1 through MW-4 by LCP in 1987. The concentrations of dissolved mercury were generally undetected in the samples.

1.10.8 1988 Blasland, Bouck & Lee Soil Investigation

In August 1988, Blasland, Bouck & Lee conducted a soil investigation around Building 231 for the proposed expansion of that building. Soil samples were collected from areas both south and north of the building, including the proposed southern expansion area (Figure 1-8). Selected samples were submitted for the analysis of VOCs, base neutral compounds, pesticides/PCBs, and inorganic constituents (Table 1-6). Nineteen samples were collected from fourteen locations. The constituents that exceeded the current NJDEP Non-Residential or Impact to Groundwater soil cleanup criteria were chlorobenzene (1.6 mg/kg), chloroform (1.1 mg/kg), hexachlorobenzene (20 mg/kg), arsenic (43 mg/kg), and mercury (up to 41,400 mg/kg). The laboratory reported that the sample with the maximum mercury concentration (S231-2A) contained visible beads of mercury.

1.10.9 Geraghty & Miller 1988 Groundwater Sampling Round

In 1988, in an attempt to demonstrate the adequacy of the monitoring well network around the brine sludge lagoon, Geraghty & Miller (1989) conducted a pressure packer study. The packer test was used to isolate the upper five feet of monitoring well screen from the rest of the boring. The packer test was conducted on monitoring wells MW-2 through MW-5. The test was not conducted on either monitoring well MW-1A, because the screen was too short (5 ft) for a packer or monitoring well MW-1, because the well was discovered to be silted up. The purpose of the packer test was to demonstrate that measurements and analytical results of groundwater quality were not dependent on the length of screen. Groundwater samples were collected from each well without a packer installed and with a packer installed and the samples were submitted for laboratory analyses. Geraghty & Miller concluded on the basis of the similarity of the analytical results of the no-packer/packer samples that the installation of additional monitoring wells was not required around the brine sludge lagoon.

1.10.10 1990-1992 Eder Shallow Groundwater Investigation

In March 1990, Eder installed four additional monitoring wells, MW-6, MW-7, MW-8, and MW-9 (Figure 1-2), to resolve the issues surrounding the effectiveness of the MW-1 through MW-5 monitoring well network. Detailed boring logs or well construction logs are not available but it appears that the base of the well screens were generally installed in the Tidal Marsh Deposit (Table 1-2).

Eder conducted eight quarterly sampling rounds between 1990 and 1992. The groundwater samples were collected from monitoring wells MW-6 through MW-9 and submitted for the analysis of six metals and water quality parameters. Groundwater sampling logs are not available so it is not known whether the samples were filtered or not.

The analyses of individual inorganic constituents in samples collected from any given well were not performed on a consistent basis. Samples collected from monitoring wells MW-6 through MW-8 generally did not contain detectable concentrations of mercury (Table 1-7). Samples from MW-9 were never analyzed for mercury. In general, the concentrations of metals in groundwater samples only exceeded NJDEP groundwater criteria for arsenic (up to 210 ug/l in MW-9) and cadmium (up to 67 ug/l in MW-7).

1.10.11 1990-1995 Linde Gases ECRA Cleanup

As described in Section 1.4.2.3, a NJDEP ECRA investigation and cleanup was conducted at the former 2.1 acre hydrogen facility in the late 1980s and early 1990s and the NJDEP approved no further action for the facility on June 20, 1995. A deed notice was required for the site because of the presence of historic fill and the presence of associated organic and inorganic constituents in groundwater and soil. The investigation showed that benzene (up to 43 ug/l), arsenic (up to 590 ug/l), lead (up to 46 ug/l) and mercury (up to 32 ug/l) impacted shallow groundwater at the Linde site. IT (1994), however, reported "Any elevated levels of contaminants in the shallow groundwater of this area are documented in the NJDEPE files as the result of off-site sources. No remediation was conducted for this area of concern".

A macadam "cap" was the remedial action for the site. With the exception of possible investigation of the distribution of historic fill across the site, additional investigations were not required by the NJDEP at this facility. It is not known whether a biennial certification for the maintenance of the engineering control (i.e., cap) is provided to the NJDEP, in accordance with current deed notice requirements.

1.10.12 1995 Malcolm Pirnie Site Inspection Sampling Event

On January 11, 1995, Malcolm Pirnie, an EPA contractor, conducted a site inspection and sampling event at the LCP site. Three surface soil samples (SL1 to SL3), ten surface water samples (SW-1 to SW-10), and eight sediment samples (SED1, SED3-SED7, SED9, and SED10) were collected for inorganic analysis. The surface soil analytical results were generally good, with detected mercury concentrations below the current NJDEP soil cleanup criterion (Non-Residential) of 270 mg/kg (Figure 1-6). In surface water, the maximum mercury concentration of 93 ug/l was detected in sample SW3 (Figure 1-7) and in sediment, the maximum mercury concentration of 1,060 mg/kg was detected in sample SED3 (Figure 1-4). These samples were collected about 40 feet downstream of the LCP and GAF outfalls. Other constituents including arsenic, cadmium, and lead also exceeded NJDEP cleanup criteria in both sediments and surface water. Malcolm Pirnie (1995) concluded that the analytical results of the surface water and sediment samples documented that a release of mercury had occurred from the site to the surface water pathway.

1.10.13 1994 Through 1998 NJPDES Permit Groundwater Sampling

Between 1994 and 1998, groundwater samples were collected from monitoring wells MW-6, MW-7, MW-8, and MW-9 on an annual basis and analyzed for selected metals. The analyses were performed to satisfy the LCP Chemicals, Inc. stormwater discharge monitoring requirements for NJPDES Permit No. 0077038. The collection of groundwater samples and analyses stopped after 1998 when the Hanlin Group, Inc officially abandoned the site.

The analytical data, provided by the EPA (March 14, 2000), are summarized in Table 1-8. The inorganic constituents of concern, as shown by these historic data, are arsenic, cadmium, lead, and mercury, although the quality of the analytical data are suspect. For example, the July 1998 analytical data for monitoring well MW-9 shows high concentrations of several constituents (up to 169 ug/l mercury), but the next round of data shown for October 1998 shows concentrations of the same constituents that are far less than their respective regulatory criteria. Neither the method of sampling (i.e., low-flow versus conventional bailer techniques) nor the analytical methods were described.

1.11 POTENTIAL SOURCES AND AREAS OF CONCERN

On the basis of the information collected during the NJDEP's and EPA's Site Inspections (NUS, 1984; NJDEP, 1988; NJDEP 1991, Malcolm Pirnie, 1995) and information compiled in this chapter, several potential sources and areas of concern were identified (Figure 1-2) and are described below. The areas of proposed investigation and the rationale for the proposed work are described in Chapter 5.0 - Scope of Work.

1.11.1 Brine Sludge Lagoon

The Brine Sludge Lagoon was an earthen surface impoundment (reported to be both unlined and lined with a spray of hot tar) in which the mercury cell process wastes were disposed. The lagoon was probably constructed in the mid 1960s. The lagoon had a trapezoid shape with an approximate footprint of 275 ft by 200 ft by 220 ft by 80 ft. Earthen dikes, about seven feet high, surrounded the impoundment. The final total volume of waste material in the lagoon was estimated to be about 31,000 cubic yards and the sludge pile grew to a height of up to 40 feet.

The normal disposal procedure was to pump brine sludge and wastewater in the lagoon. The supernatant was pumped back to the wastewater treatment system for salt resaturation and treatment from a sump located in a pump house at the southeast corner of the lagoon. The solid waste was stored in the center of the impoundment. A crane was used (at least once in 1981) to shape the solid sludge pile and to improve the supernatant flow to the pump house.

In March 1982, the chlorine production stopped at the site because of poor market conditions. In July 1982, when the sludge roaster permit was rejected by the NJDEP, LCP Chemicals was

Exhibit H

LCP CHEMICALS -- NEW JERSEY, INC.
HANLIN GROUP, INC.
EDISON, NJ

DESCRIPTION OF CURRENT CONDITIONS
RCRA FACILITY INVESTIGATION TASK I
LCP CHEMICAL - NEW JERSEY, INC.
LINDEN, NJ

PROJECT #625-3
JANUARY 1992

EDER ASSOCIATES
CONSULTING ENGINEERS, P.C.
Locust Valley, New York
Madison, Wisconsin
Ann Arbor, Michigan
Augusta, Georgia

eder associates
consulting engineers, p. c.

February 19, 1992
File #625-3

Mr. Samuel I. Ezekwo
United States Environmental
Protection Agency
Region II
Hazardous Waste Facilities Branch
26 Federal Plaza
New York, New York 10278

Re: LCP Chemicals - New Jersey, Inc.
NJD079303020

Dear Mr. Ezekwo:

On behalf of LCP Chemicals - New Jersey, Inc., a Division of Hanlin Group, Inc., enclosed are three copies of the Description of Current Conditions for the Linden, New Jersey facility (EPA ID. No. NJD079303020) representing Task I of the Scope of Work for the RFI, as required by the facility's HSWA permit. We revised the draft version of this report to include the RFA and a pre-RFI site investigation report as requested. Also, more detailed descriptions of SWMUs, Areas of Concern, and permit and enforcement actions have been added, as requested.

Task II Evaluation of Corrective Measure Technologies and the Task III Work Plan will be submitted in accord with the permit deadlines of February 23 and March 25.

Please call me if you have any questions.

Very truly yours,

EDER ASSOCIATES CONSULTING ENGINEERS, P.C.

Kenneth J. Pasterak
Hydrogeologist

KJP/eml
enc.

cc: J. Merle
B. Marcolina

LLV2035

100599

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I. PURPOSE

This document describes past and current conditions and activities, identifies solid waste management units (SWMUs) and areas of concern (AOCs), and presents a preliminary assessment of potential impacts caused by prior activities. The document has been prepared as Task I of the RCRA Facility Investigation for the Hanlin Group, Inc., LCP Chemicals - New Jersey (LCP) Division Linden facility, in accord with Module III, Section E.1 of the LCP 1984 HSWA (NJD079303020) effective November 25, 1991.

II. BACKGROUND INFORMATION

Site History

LCP Chemicals purchased a 26 acre chlorine production facility in Linden, New Jersey from General Aniline and Film Corporation (GAF) in 1972 (Figure 1). GAF purchased the land from the U.S. government in 1950, filled an area of marshland and lowland, and developed it for chlorine production. The facility is situated on the Tremley Point peninsula adjacent to the Arthur Kill. South Branch Creek, a tributary of Arthur Kill, runs through a portion of the site and flows through engineered conveyance structures on the north side of the property.

GAF produced chlorine and sodium hydroxide by the mercury cell electrolytic process beginning in 1952. LCP purchased the site in 1972, renovated the plant, and operated the mercury cell process until 1982. LCP Chemical produced chlorine, sodium hydroxide, hydrochloric acid, and anhydrous HCL. In the early 1980's the plant was converted to produce potassium hydroxide and operated briefly before it permanently ceased production in August 1985.

The site is now used as a transfer terminal for products from other Hanlin Group facilities. Dismantling activities have been ongoing since 1985. Presently, products including potassium hydroxide, sodium hydroxide, and hydrochloric acid arrive in bulk by rail and truck and are transferred to aboveground tanks and tank trucks. Administrative tasks and product storage and transfer are the only activities currently conducted at the site.

A portion of the site west of Avenue D was leased to the Union Carbide Linde Division from 1959 to 1990 and was used in its wholesale gas activities. Beginning in 1990, Ultra Pure Compressed

Gasses, Inc. leased the site for the same operation. Building 231 has been leased to Microcell Technologies since 1987. From 1974 to 1981 Kuehne Chemical manufactured sodium hypochlorite and chlorine in a leased area near Building 220. Caleb Brett Labs leased a portion of a laboratory and locker building north of Building 220 to store petroleum product samples and a portion of the building was also leased to Liquid Carbonic for office use. Land adjacent to the lab and locker building was leased to Liquid Carbonic for carbon dioxide transfer operations.

Surrounding Land Use

The facility is owned by Hanlin Group, Inc., Edison, NJ. Property boundaries and adjacent property owners are identified on Drawing 1. All surrounding land use is heavy industrial and the nearest residence is approximately 0.75 miles to the west. The City of Linden is a densely populated urban area of about 60,000 people and is about three miles west of the site.

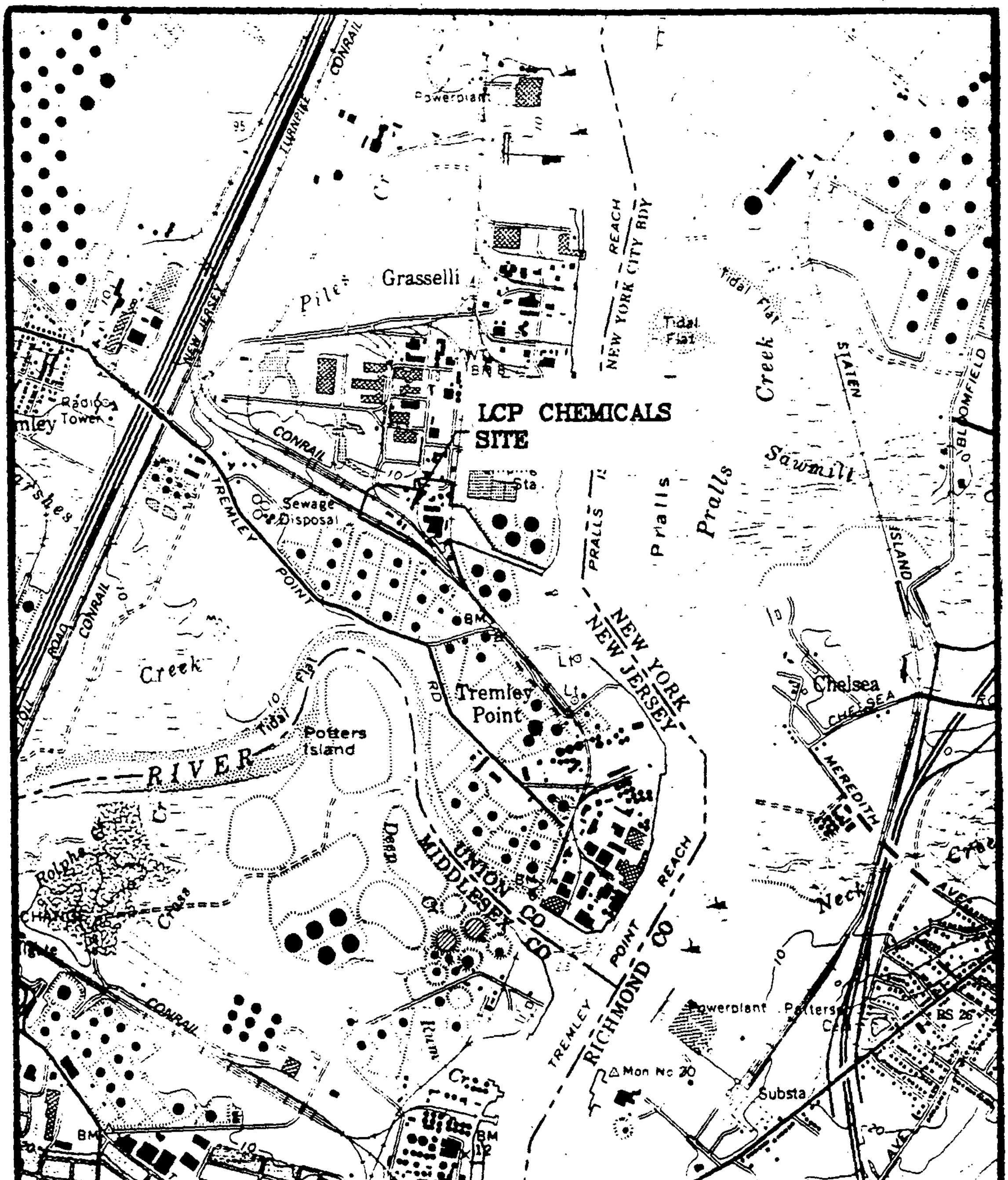
GAF occupies land immediately north of LCP and produced surfactants and pharmaceutical specialty products. The GAF Corporation site became inactive in April 1991. Bulk petroleum storage terminals owned by Northville, BP, and Mobil occupy land to the northeast, south and west.

Surface Drainage

Roads (Avenues A, B, C, D and E depicted on Drawing 2), electrical substations, and secondary containment areas around tanks are paved. The remainder of the site is essentially unpaved. Stormwater runoff from former process areas collects in a concrete drainage swale drawn in Drawing 2 or infiltrates the soil in unpaved areas. The swale (date of construction unknown) conveys runoff to a concrete sump south of Building 231 where it is pumped to a holding tank for treatment.

eder associates consulting engineers, p.c.
FIGURE 1

LCP CHEMICALS–NEW JERSEY, INC.
A DIVISION OF HANLIN GROUP, INC.
LINDEN, NEW JERSEY



SCALE 1"=2000'

LOCATION MAP

100605

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Land outside the process area is generally unpaved, except for roadways (identified on Drawing 2) and tank containment areas, and precipitation percolates through soil to the shallow water table, eventually discharging to South Branch Creek and the Arthur Kill.

According to LCP, no topographic contour maps exist for the plant site. A topographic map will be prepared as part of the RFI to fulfill LCP's HSWA permit map requirement.

Principal Activity Conducted at the Site

Salt and water were the principal raw materials used by LCP in its production processes. Rock salt (and, in 1982, evaporated salt) was transported to the facility by rail car, placed in salt silos by building 233, and fed to saturators to generate brine. The brine was treated and filtered in building 233 to remove calcium carbonate, calcium sulfate, magnesium hydroxide and other impurities. Purified brine was fed to electrolytic mercury cells in buildings 230 and 240 to produce chlorine and a mercury-sodium amalgam. Chlorine was cooled, dried with sulfuric acid, liquified in building 233 and stored in 100 ton vessels. Spent brine was returned to building 233 for neutralization, re-saturation, filtration and return to the cells. The mercury-sodium amalgam flowed from electrolyzers to denuders where it was reacted with water to produce elemental mercury, sodium hydroxide solution and hydrogen gas. Hydrogen gas was purified south of building 231 and elemental mercury was returned to the electrolyzers, completing the process.

Sodium hydroxide was filtered and stored in tanks at the north end of the facility and some was reacted with water and chlorine to produce sodium hypochlorite. Hydrogen was burned for energy recovery or with a stream of chlorine and water to produce hydrochloric acid which was stored in tanks near building 221.

Hydrogen chloride was desiccated with sulfuric acid to produce anhydrous hydrochloric acid. All product was shipped off-site by rail or truck.

Solid and Hazardous Waste Generation

Brine purification mud ("brine sludge") was the principal solid waste generated at this site during production, and mercury is the basis for listing the sludge as Hazardous Waste No. K071. In 1971, brine sludge was pumped from building 233 to an on-site lined settling lagoon and LCP continued this practice. Sludge was pumped to the lagoon via aboveground line and through a hose inside pipe underneath the railroad right of way as depicted in Drawing 3. On one occasion, a small amount of sludge was pumped from the brine sludge lagoon to a lined experimental chemical fixation lagoon for treatment and monitoring. LCP investigated sludge treatment to render the K071 waste non-hazardous and retorted the sludge in a roasting unit on a pilot scale basis for several years. All waste management units are described in Report Sections IV and V.

Wastewater treatment sludge was also generated during chlorine production and is a RCRA listed hazardous waste (No. K106) on the basis of mercury content. This waste was placed in the on-site lagoon during LCP's ownership of the facility.

Small quantities of solvent such as carbon tetrachloride were probably used for general cleaning and degreasing, and small quantities of methyl ethyl ketone were used in the fiberglass shop.

LCP is registered as a RCRA hazardous waste generator (No. NJD079303020) and currently generates demolition debris from the plant closure some of which is contaminated by mercury. Filter cake from the wastewater treatment system is also generated and is disposed of off-site as mercury contaminated waste. Both wastes are listed as D009 and are generated on an irregular basis, with an estimated volume of 60 tons/year. Waste oil from diesel locomotive servicing could also potentially be generated.

Wastewater Handling

Storm water runoff collects in drainage swales (shown in Drawing 2) surrounding the former process area and is routed to a concrete sump south of building 231. Runoff is piped to holding tanks outside building 233 and is pH adjusted, filtered, polished with activated carbon and stored pending discharge once or twice a year in accord with LCP's NJPDES permit. The collected stormwater is occasionally used to wash down structures and equipment in the former process area. The wastewater treatment system at building 233 has been operational since the early 1980's.

Prior to LCP's ownership of the site, process wastewater was conveyed to a pond (the GAFRAC unit) along Avenue D east of the main switch yard, was pH neutralized, and was filtered through carbon in the northwest corner of the facility and discharged to South Branch Creek. In the mid 1970's the GAFRAC pond was reportedly excavated, filled with soil, and covered with asphalt. The pond will not be investigated as part of the RFI. It is not known when the GAFRAC pond and wastewater treatment system were constructed.

When the cells were operational, wastewater generated by cell washdown and cell maintenance drained to a floor trench which emptied to a concrete floor sump in buildings 230 and 240 where it was pumped through overhead piping to the GAFRAC pond. During LCP's operation of the plant, this wastewater was pumped form the cell room sumps to a holding tank, and to the wastewater treatment system.

Underground Tanks and Piping

There are no known underground tanks at the facility except for septic systems (Drawing 3).

Known underground piping includes fresh and river water (now inactive) mains and service lines, a 36 inch storm sewer that was plugged around 1974 (see discussion in Surface Water section), cooling tower water feed and return lines, septic leach fields, a section of pipe through which a flexible hose was run to pump brine sludge from building 233 to the brine sludge lagoon (about 30 lineal feet) and a nitrogen line. The approximate location of known piping is depicted on drawing 3.

Concrete trenches in building 230 and 240 cell rooms collected washdown water and any release of mercury which might have occurred during cell maintenance and rebuilding activities. The trenches drained to a concrete sump in the northwest corner of each cell room and the sump contents was pumped to the effluent treatment system. The concrete floors in the cell rooms were re-paved with epoxy and concrete at least once in the 1970's to cover spalled areas and improve drainage to the trenches and sump.

Location of Production, Injection, and Monitoring Wells

Six monitoring wells were installed in 1981 around the brine sludge lagoon and MW1, MW2, MW3, MW4, MW5 are monitored semi-annually to determine the impact of the lagoon on alluvium groundwater. Four additional monitoring wells, MW-6, MW-7, MW-8 and MW-9 were installed in 1990 to comply with an NJDEP request. Boring logs and well construction details are in Appendix A.

Shallow groundwater in the area is not used as a potable water source due to salt water intrusion. There are two public water supply well fields within a four mile radius of the facility reportedly screened in the Brunswick Formation. The Elizabethtown Water Company field is about 3.5 miles northwest of LCP and the City of Rahway field is about 3.5 miles west of LCP. The facility's water supply source is Elizabethtown Water Company mains.

Hydrogeology

Site hydrogeology is described in the February 1982 Geraghty & Miller, Inc. report, Waste Lagoon Ground-water Monitoring. The site is located on a thin layer of glacial and alluvial deposits which overlie the Brunswick Formation of Triassic age. The upper 5 to 15 feet of unconsolidated deposits consist of artificial fill comprised of silt, sand, gravel, cinders, crushed stone and brick, underlain by up to five feet of organic clay and silt. Beneath the organic clay and silt is 4 to 18 feet of poorly sorted gravelly sand and 14 to 29 feet of silty clay with a layer of pebbles and cobbles at the base. The depth to bedrock is 40 to 50 feet below grade based on data collected during drilling at monitoring well locations and building foundation borings. The water table is 5 to 10 feet below grade and the groundwater is brackish due to tidal influence from surrounding surface water bodies.

Groundwater beneath the site evidently discharges to South Branch Creek and/or Arthur Kill and there are no water supply wells between the facility and these surface waters. Downstream surface water in Arthur Kill is not used as a potable source.

Permit Issuance and Enforcement Action History

The following is a summary of permitting and enforcement actions based on information from LCP, NJDEP and USEPA Region II files:

The plant at this site was operated in accord with certain housekeeping and operational requirements established by USEPA NESHAP in the mid 1970's to ensure mercury releases to air during operation were below 1300 g/d.

LCP was fined by NJDEP for supernatant overflows from the brine sludge lagoon in 1972 and 1974. The overflow location(s), quantity released, and response measures employed are unknown.

A sodium chloride blockage in LCP's east saturator caused the release of 10,000 to 20,000 gallons of brine to South Branch Creek in August 1979 resulting in enforcement action. A brine sample was analyzed at the time of the spill and was found to contain 8.6 ppm mercury.

Kuehne Chemical was issued a NPDES permit in August 1980 for cooling water discharge to Arthur Kill. NJDEP cited and fined Kuehne Chemical in 1981 for an NPDES violation of pH and free chlorine, apparently relating to discharge of unknown quantities of acid and caustic.

In September 1981, NJDEP issued an Administrative Consent Order to LCP requiring the closure of its brine sludge lagoon and implementation of air, soil and groundwater monitoring. Initial data collected during the investigation was summarized in a February 1982 Geraghty & Miller, Inc. report <u>Waste Lagoon Groundwater Monitoring</u>. The brine sludge lagoon was closed in 1984 and 1985.

In 1980, LCP filed a RCRA Part A permit application for hazardous waste storage in tanks and a surface impoundment. Hazardous waste was never stored in tanks, however, and LCP's filing was reportedly incorrect.

In March 1980, NJDEP granted LCP a permit to construct and temporary certificate to operate a brine sludge roaster and dryer. In November 1981, NJDEP issued CLP a Motion of Violation for a ruptured muffler plate and operation of unpermitted propane burners for the sludge roaster system. In 1982 USEPA requested that the brine sludge lagoon be closed and the plant shut down as a safety precaution during lagoon closure.

A site inspection and hazardous ranking system determination was conducted by USEPA in 1984. LCP was cited in 1988 by NJDEP for groundwater exceedances at the brine sludge lagoon and failure to report groundwater monitoring data. The groundwater exceedances were reportedly associated with salt water intrusion at downgradient monitoring wells and were not indicative of a release. The failure to report was apparently the result of an oversight by LCP.

In 1990, NJDEP found gaps in LCP's groundwater monitoring data submittals during a compliance evaluation inspection and LCP addressed these in a response.

LCP currently holds a surface water discharge permit (NJ0003778) for discharge of treated wastewater and also a RCRA permit (HSWA portion only).

Copies of permits and enforcement related correspondence are in Appendix B.

III. NATURE AND EXTENT OF CONTAMINATION

History of Spills and Releases

The following releases and spills at the facility were documented by NJDEP:

Supernatant overflows from the brine sludge lagoon to South Branch Creek were observed by NJDEP on October 30, 1972 and February 7, 1974. The overflow locations, quantities, and nature of LCP's response are unknown. In June 1975, a brine recycle pump failed and a breach in the brine sludge lagoon occurred. An undetermined quantity of brine entered South Branch Creek for an estimated nine hour period. The location of the release was likely near the southeast corner of the lagoon but the exact location is unknown. It is not known what, if any, remedial measures were performed other than mechanical repair of the pump.

A release of 10,000 to 20,000 gallons of brine to South Branch Creek occurred August 20, 1979 due to sodium chloride blockage in the saturator. A brine sample was collected and analyzed at the time of the release and was found to contain 8.3 ppm mercury. The breach was remediated. It is unknown what, if any, other remedial measures were implemented.

Releases from piping near the 500,000 (500 K) gallon tank were observed on September 17, 1980, June 21, 1981, October 22, 1981 and August 13, 1982. Releases occurred along the side of the tank and along and east of the railroad tracks. The volume and nature of released liquid is unknown. It is unknown what, if any, remedial measures were implemented.

A brine sludge slurry spill was observed on pavement below salt silo #4 on October 9, 1980, according to an NJDEP inspection report. This slurry flowed into the adjacent drainage swale according to LCP.

Kuehne Chemical was cited in 1981 for discharging acids and caustics to Arthur Kill. The quantity of material discharged is unknown. It is unknown what remedial measures, if any, were implemented.

Sludge or brine was observed in the bullet tank farm containment area on September 17,1980, October 9, 1980. May 19, 1981, June 22, 1981, September 29, 1981 and August 13,1982. The nature and source of this sludge are unknown. According to LCP, the sludge (or sediment) was flushed out with water to the adjacent drainage swale which led to a collection sump as described in the Surface Runoff section of this report.

Union Carbide reported a release of 60,000 cubic feet of hydrogen gas in September 1988 and a series of waste oil releases which were remediated by excavation of contaminated soil in May 1988. A small amount of mercury contaminated soil was found and removed from the vicinity of a hydrogen tank in 1988 on land leased by Union Carbide. The quantity of soil excavated and the spill location are unknown.

In the early 1980's, NJDEP found a hole in a muffler plate on the sludge roaster which allowed mercury vapor to discharge. The volume of mercury released is unknown and the roaster was shut down as requested by NJDEP.

Copies of inspection and spill reports are in Appendix D.

Past Investigations

On July 31, 1981, NJDEP issued an Administrative Consent Order to LCP requiring implementation of air, soil and groundwater monitoring for the brine sludge lagoon. Data collected during the investigation was summarized in a February 1982 Geraghty & Miller, Inc. report Waste Lagoon Ground-water Monitoring.

Groundwater monitoring data associated with the brine sludge lagoon has been generated and reported to NJDEP since the unit was closed in 1984. Monitoring well construction data is contained in the February 1982 Geraghty & Miller, Inc. report, Waste Lagoon Ground-water Monitoring. There has been no indication of an on-going release to groundwater from this unit although barium was detected at concentrations exceeding the 1 ppm NJDEP Action Level. Manganese, iron, sulfate, and total dissolved solids were detected in upgradient and downgradient monitoring wells at concentrations exceeding the permit levels, but high ambient levels would not be unusual in local groundwater due to the geochemistry of the Brunswick Formation (sulfate mineralization) and the brackish nature of local groundwater due to tidal influence. Mercury was detected at concentrations exceeding the drinking water standard on one occasion in 1982 but the data quality is suspect.

According to the 1982 Waste Lagoon Ground-water Monitoring Report, mercury concentrations up to 1,580 parts per million (ppm) were found in surface soil samples collected near the sludge roaster and near Building 231. Soil samples collected during monitoring well drilling were analyzed for mercury and were found to contain concentrations at ground surface up to 772 ppm, dropping to less than 10 ppm below 10-17 feet below grade. One sample of bottom sediment, from South Bend Creek contained 46.62 ppm mercury.

A site inspection and hazard ranking system scoring was conducted in 1984 by NUS Corporation for USEPA. NUS reported the potential for soil and groundwater contamination impact to Arthur Kill flora and fauna. No potential impacts to potable water supplies were identified.

Unidentified organic vapors were reportedly detected by NJDEP in the headspace of several of the monitoring wells during site inspections conducted in 1987 and 1989.

Analytical data from soil samples collected in 1988 around building 231 as part of a site evaluation for expansion of the building indicated the presence of mercury and volatile organic constituents in soil and all of this data was submitted to NJDEP. This area will be investigated further during the RFI, as described in Section V.

Areas of Potential Contamination

Mercury is the most likely potential soil contaminant at this site. Solvents used for general parts cleaning (such as carbon tetrachloride, acetone, and methyl ethyl ketone) and their decomposition products could also be present if solvent was ever spilled or released. Section V identifies and describes potential source areas.

Potential Migration Pathways

Site hydrogeology was described in the February 1982 Geraghty & Miller, Inc. report, Waste Lagoon Ground-water Monitoring. Groundwater beneath the site likely discharges to South Branch Creek and/or Arthur Kill and there are no water supply wells between the facility and these surface water features. The prevailing wind direction is from the west and northwest. Potential migration pathways include surface water runoff, groundwater migration, air releases from contaminated soil and wind-blown soil. There is no data indicating contaminants are migrating from the site at this time.

IV. HAZARDOUS WASTE GENERATION, TREATMENT, STORAGE AND DISPOSAL AREAS

Areas known to have been used for treatment, storage, and disposal of hazardous waste, and areas where hazardous waste was reportedly generated, are described below.

Brine Sludge Lagoon

Up to 20 tons/day of brine sludge were generated and discharged along with wastewater treatment sludge to an earthen lagoon east of building 231 (Drawing 1). The lagoon was constructed around 1970 by GAF Corp. and the interior was reportedly sprayed with hot tar as a lining. Sludge was piped to the lagoon until chlorine production was discontinued in the mid 1980's. During the operating life of the lagoon supernatant was collected at a sump in the southeast corner of the lagoon and was piped to the wastewater treatment system. There is no information indicating that any wastes other than brine filtration sludge and wastewater treatment sludge were deposited in the lagoon.

Brine sludge in the lagoon is likely comprised of calcium carbonate, cellulose fiber, water, magnesium and ferric hydroxides, and mercuric sulfide.

At the time the lagoon was closed in 1983-84, it contained an estimated 30,900 cubic yards of sludge and occupied about 3,000 square feet. The lagoon was capped with two feet of compacted clay overlain by six inches of drainage media and six inches of soil capable of supporting vegetative cover in accord with the RCRA closure regulations (40 CFR 265.110) and the Closure and Post Closure Plan for Brine Sludge Lagoon approved by the NJDEP Division of Waste Management in 1983. The fate of brine sludges generated by GAF Corp. prior to this lagoon is unknown however.

Groundwater monitoring around the closed lagoon continues and monitoring data are submitted to NJDEP after each sampling event. The database does not indicate that the brine sludge lagoon is releasing mercury to groundwater. The lagoon cover is inspected and maintained in accord with NJDEP post-closure requirements. The closed unit is not subject to the investigation and corrective action requirements of LCP's HSWA permit.

Building 233

Building 233 was used for brine filtration until the early 1980's when it was converted for wastewater treatment. Wastewater treatment sludge is currently generated here and is managed as hazardous waste. An October 1980 NJDEP inspection documented brine caked on the floor near the filters. The brine was washed to the runoff collection sump and treated. There is no evidence of releases from this building and it will not be investigated in the RFI.

Brine Sludge Roaster

Around 1980 a brine sludge roasting kiln and a packed scrubber were constructed on a concrete pad south of the brine sludge lagoon to recover mercury. Mercury-bearing Brine sludge waste from LCP's process was roasted to remove mercury and treated sludge was placed in the brine sludge lagoon. The unit was operated on a trial basis under a temporary NJDEP permit to construct and operate an air emission source. A permit for full scale operation was never obtained due to unresolved air emission issues and the unit was shut down. It was dismantled in 1985.

The roaster was built on a one foot thick, 16 by 40 foot concrete pad surround by a cinder block curb with drain channels connecting to the effluent treatment plant. This location will not be investigated in the RFI since it is unlikely that hazardous constituents were released to soil or groundwater in this area. The RFI-VSI conducted December 22, 1987 included an inspection of this unit and no release was evident. It will not be investigated in the RFI.

Chem-Fix Lagoon

A lined lagon was used to study the effectiveness of treating LCP's brine sludge waste. This unit will be included in the RFI and is described in the following section.

GAF Wastewater Treatment Area

During GAF's ownership of the site in the 1950's to 1970's, process wastewater and wastewater from the cell room trench sumps was reportedly routed to and stored in a pond east of the main switch yard prior to treatment. The pond was excavated and paved to support a transformer substation in the early 1970's. This area will not be investigated as part of the RFI.

V. SOLID WASTE MANAGEMENT UNITS AND AREAS OF CONCERN

The solid waste management units and areas of concern that will be investigated as part of the RFI are identified and described below.

Chem-Fix Lagoon

The Chem-fix lagoon was constructed as a pilot scale test in 1976 to determine if mercury in the brine sludge could be rendered immobile, thereby allowing the treated sludge to be managed as non-hazardous waste. The lagoon was triangular, approximately 70 feet per side, and was located north of the brine sludge lagoon (Drawing 2). The lagoon was lined with two impermeable geosynthetic liners and contained a granular media leachate collection base sloped to a sump to allow leachate to be collected and pumped to the adjacent brine sludge lagoon.

In 1976, approximately 120,000 gallons of brine sludge were pumped to the Chem-Fix Lagoon and treated. The lagoon sump was monitored and sampled until 1980, and samples were analyzed for mercury. The lagoon was closed in 1983 and 1984 in accord with the Closure and Post-Closure Plan for Brine-Sludge Lagoon approved by NJDEP. In 1983 an estimated 460 cubic yards of brine sludge were removed from the Chem-fix Lagoon and placed in the brine sludge lagoon along with the synthetic liner and leachate collection material.

Based on company records and information from employees there is no indication that the lagoon leaked or that brine sludge or leachate were released to soil or groundwater. Groundwater monitoring data from monitoring wells downgradient of the unit do not indicate that a release not indicate that a release to groundwater has occurred. Nonetheless, the USEPA RFI protocol requires that soil samples be collected in the area of the former lagoon to determine if a release occurred.

Salt Silo #4

Salt silo #4 was one of four salt storage silos adjacent to Building 233 and is believed to have been constructed in the 1950's or 1960's. In 1980 and 1981, silo #4 was used to mix water with brine sludge and the resultant slurry was pumped to the sludge roaster. NJDEP reportedly observed brine sludge on the ground around the silo during an October 1980 inspection. The area beneath and around the silo was reportedly paved in the early 1970's and sludge released from this unit would have likely entered the adjacent drainage swale. The drainage swale empties to a concrete sump where wastewater is collected and pumped to the treatment system. The silos were dismantled in the mid 1980's.

Soil samples will be collected to determine if mercury is present in soil around the pad and, if the pad is cracked, soil beneath the pad will also be sampled.

Process Areas in Buildings 230 and 240

The floors in the cell rooms were paved and contained concrete trenches leading to a sump for conveyance and collection of washwater and potential spills. Aboveground piping conveyed wastewater from the sumps to the treatment system. The concrete floor spalled over time and was paved over on several occasions to improve flow to the trenches and reduce pooling of water. A former LCP employee told NJDEP in 1981 that LCP resurfaced significantly cracked floors in the cell rooms but LCP employees and plant records do not indicate that significant cracks in the cell room were ever covered over. In 1976 OSHA inspected the buildings and reported cracks in the floor and walls but there was no indication of mercury contamination of soil. Soil beneath and around the two buildings will be investigated to determine if a release of mercury or mercury contaminated brine has occurred through joints or cracks in the floors of Buildings 230 and 240.

500 K Tank

A 500,000 gallon tank was constructed in the 1950's or 1960's south of Building 231 for brine storage prior to pumpage to the cells. Sodium hydroxide produced in Buildings 230 and 240 was on occasion also stored in this tank. The tank (referred to as the 500 K tank) was, in the 1970's and early 1980's, used to store wastewater prior to treatment. The tank was dismantled in the late 1980's and the concrete pad remains.

Releases near this tank occurred in the 1970's and 1980's. NJDEP observed brine sludge near the tank in September 1980 and liquid was observed leaking from a pipe near the tank in January 1981. Brine sludge slurry was present on the ground on one occasion in 1980 along the sludge and return pipes leading to the brine sludge lagoon and leakage from one of these pipes was observed by NJDEP between the lagoon and the railroad tracks in 1981. Sodium sulfide crystals were observed on the gravel surface in the pump pit area in 1980. The exact locations of these releases are unknown. A hydrochloric acid spill was observed 15 ft. northwest of the tank by NJDEP during an October 22, 1981 inspection. Releases will be investigated in these areas by soil sampling and, if warranted, groundwater sampling.

Bullet Tanks

The tanks referred to as bullet tanks were constructed as pressurized storage vessels for chlorine in the 1950's or 1960's. They were later used for storing treated and untreated wastewater and for product storage. The aboveground tanks were equipped with secondary containment prior to conversion to wastewater storage and there is no information to suggest that a release ever occurred. In the 1980's, standing water occasionally approached the capacity of the containment area. The "continual problems with brine containment" in 1980 and 1981 mentioned in LCP's HSWA permit evidently refers to the standing water problem, however, precipitation - not brine or wastewater - was likely in the containment area according to LCP personnel.

"Brine residues" were reportedly observed in the containment area during NJDEP inspections between September 1980 and April 1982 according to the LCP RFA. Sludge or sediment in the containment area was occasionally flushed out to the adjacent drainage swale. It is not likely that this material was brine sludge according to LCP personnel.

Soil and, if warranted, groundwater will be investigated, however, to determine if a release occurred from these tanks.

Area South of Building 231

A Purasiv® hydrogen purification unit was located immediately south of building 231 during production at the facility, and releases of mercury could have occurred in this area. Soil sampling and analysis was conducted in 1988 (see Appendix C). Mercury and volatile organic contamination of soil was found in samples collected on the north, south, and west side of the building, and all analytical data were provided to the NJDEP in a November 8, 1988 letter report. A former LCP employee told NJDEP in 1981 that brine sludge was placed on the ground between Building 231 and the railroad tracks.

Soil and, if necessary, groundwater in the vicinity of building 231 will be investigated as part of the RFI.

Drum Storage Area

A drum storage area was located in the southwest perimeter of the facility (Drawing 2). Motor oil, gear oil, waste oil and possibly Freon (used in chlorine liquifiers) were stored in drum quantities (55 gallons or less) on a 300 square foot concrete pad with secondary containment. The concrete base is one foot thick with a six inch secondary containment curb. Waste solvents could have been stored here but LCP employees do not recall this.

In December 1987 NJDEP reportedly found oily residue on the gravel outside the pad and in April 1989 NJDEP found stained soils and organic vapors near the pad. There are visible cracks in the containment wall and petroleum residue is evident on the ground in one small area outside the pad. The nature and extent of contamination around and beneath the pad will be investigated by soil sampling and, if necessary, soil vapor and groundwater sampling.

Lined Trenches

Swales consisting of open concrete trenches surround most of the production area and collect surface water runoff and conveys it to a sump where water is pumped to the wastewater treatment system holding tank. These surface water collection swales, shown in Drawing 2, were constructed in the 1970's (exact date unknown) and will be investigated to determine if they contain mercury-contaminated sediment. Soil beneath and around the swales may also be investigated if there is evidence of past overflow or seepage through expansion joints, in which case mercury could be present in the subsurface.

Transformers

Stained soil has been reported at the former location of transformers and rectifiers west of buildings 230 and 240 and at the northeast corner of Building 231. Soil will be investigated for releases of petroleum hydrocarbons and polychlorinated biphenyls.

Process Sewers

Concrete trenches and a sump in buildings 230 and 240 were used to collect brine and residual mercury when the cell room was washed down. Wastewater from the sumps was pumped to the wastewater treatment system. Mercury was collected in a second closed sump and was recovered for reuse. Soil in the vicinity of the wastewater piping will be investigated to determine if a release of mercury occurred during production.

South Branch Creek

Supernatant overflows from the brine sludge lagoon to South Branch Creek were observed by NJDEP on October 30, 1972 and February 7, 1974, and reported to USEPA in June 1975. The exact locations and quantities of these releases is not known.

The proximity of the site and, in particular, the brine sludge disposal area, to South Branch Creek suggests that the Creek could have also received contaminated surface water runoff or groundwater discharge from a spill or release during the operating history of the production activities at this site. Mercury is the only waste constituent which would be expected to be present since the use of solvents was reportedly restricted to small quantities during LCP's ownership. Volatilization and hydrolysis would be expected to significantly reduce any concentrations in soil if there was a small quantity release during production activities.

VI. IMPLEMENTATION OF INTERIM MEASURES

Post-closure monitoring of the brine sludge lagoon continues in accord with the approved post-closure plan (see Section IV, Brine Sludge Lagoon). LCP also continues to recover and treat production area surface runoff (see Section V, Lined Trenches).

VII. BIBLIOGRAPHY

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APPENDIX A

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SYOSSET, NEW YORK 11791

WELL LOG

PROJECT N 418 LD-1
CLIENT LCP Chemicals Inc.
DATE PREPARED 10-9-81 BY J. DeMartini

DEPTH, ft	S.S.	DESCRIPTION	L.S.
0		EXISTING GRADE EL 9.7 Ft.	
# 1.1	S.S.	Fill, Heterogeneous: slag, cinders and bricks	A
# 1.2	S.S.	Clay, Black-Gray, Organic, Moist to Dry V. Cohesive: Wet From G.S. To 8 Ft.	B
10 # 1.3	S.S.	Peat, Brown (Layers 2 to 6 in. Thick) Organic Matter Disseminated Througnout: Strong H2S Ordor.	B
# 1.4	S.S.	Silty, Red-Brown, Tight, Clayey, Dry: with Fine Sand and Embedded Pebble Gravel	D
20 # 1.5	S.S.	Clay, Red-Brown, Tight, Dry With Fine Sand and Embedded Gravel	D
# 1.6	S.S.	Clay, Red-Brown with Embedded Pebbles: Tight.	D
30 # 1.7	S.S.	Clay, Red-Brown, Moist: Less Pebbly Than Above.	D
# 1.8	S.S.	Clay, Silty, Red-Brown, Dry With Abundant Pebbles And Cobble, Gravel.	D
40 # 1.9	S.S.	Silty, Clayey, Dry, Red-Brown: Cobbles And Gravel.	D
		Bedrock @ 42.3 Ft. Boring Stopped	

L.S.=Land Surface
\# - S.S.=Split Spoon Core Sample Number

OWNER LCP Chemicals Inc.
WELL NO. 1 State # 26-5293
LOCATION Lagoon Area Linden, N.J. Plant
TOPO SETTING Filled Coastal Marsh
GROUND ELEV. 9.7 Ft.

DRILLING STARTED 9-29-81
DRILLING COMPLETED 9-29-81
DRILLER H. P. Drilling
TYPE OF RIG Drive Boring

WELL DATA

HOLE DIAM. 2 1/2 inch.
FINAL DEPTH 38.5 Ft.
CASING DIAM. 1 1/2 inch.
CASING LENGTH 20 Ft. (1.5 Ft. Above LS
SCREEN DIAM. 1 1/2 inch.
SCREEN SETTING 18.5-38.5 Ft.
SCREEN SLOT & TYPE 20 Slot PVC
WELL STATUS Monitoring

DEVELOPMENT

TEST DATA

STATIC DEPTH TO WATER 4.78 Ft. 4.01 Ft.
DATE MEASURED 10-6-81 10-15-81
Low Tide High Tide
Measuring Point Top of PVC Pipe
Meas. Point Elevation 9.01 Ft.
DATE OF TEST
TYPE OF TEST
PUMP SETTING
SPECIFIC CAPACITY

FINAL PUMP CAPACITY
FINAL PUMP SETTING
AVERAGE PUMPAGE

WATER QUALITY

See Appendix

LITHOLOGY REMARKS SEE TABLE 1
A= Miscellaneous Fill Deposits
B= Dark Gray Organic Clay
C= Well Sorted Sands Etc.
D= Silts, Clays Etc. (Glacial Till)

100631

WELL LOG

PROJECT N 418 LD-1
CLIENT LCP Chemicals Inc.
DATE PREPARED 10-9-81 BY J. DeMartini

DEPTH, ft	Sample	DESCRIPTION	
0		EXISTING GRADE EL. 6.5 Ft.	L.S.
#2.1	S.S.	Fill, Loose Brown Silt and Sand: Abundant Organic Matter	A
#2.2	S.S.	Clay, Silty, Gray; Moist to Dry Organic Matter Disseminated Throughout. Strong H2S. Smell	B
10 #2.3	S.S.	Clay, Silty, Gray, Dry with Strong H2S smell; 0.5 Ft. Layer of Brown Peat	B
#2.4	S.S.	Clay, Silty, Red-Brown, Dry with Fine Sand and Gravel Pockets; Basalt Clasts. Green Staining; Reducing Conditions	D
20 #2.5	S.S.	Clay, Silty, Dry, Red-Brown, Tight with Metamorphic and Igneous rock fragments.	D
#2.6	S.S.	Clay, Red-Brown, Dry with Sparse Gravel	D
30 #2.7	S.S.	Clay, Red-Brown, Dry, Soft	D
#2.8	S.S.	Clay, Red-Brown, Dry with Embedded Gravel	D
40 #2.9	S.S.	Clay, Red-Brown, Dry with Abundant Gravel; Granite Fragments	D
		Bedrock @ 43 Ft. Boring Stopped	

L. S.=Land Surface
#-S. S. = Split Spoon Core Sample Number

OWNER LCP Chemicals Inc.
WELL NO. 2 State # 26-5294
LOCATION Lagoon Area
Linden, N.J. Plant
TOPO SETTING Filled Coastal Marsh
GROUND ELEV. 6.5 Ft.

DRILLING STARTED 9-30-81
DRILLING COMPLETED 10-1-81
DRILLER H.P. Drilling
TYPE OF RIG Drive Boring

WELL DATA

HOLE DIAM. 2 1/2 inch.
FINAL DEPTH 28 Ft
CASING DIAM. 1 1/2 inch.
CASING LENGTH 20 Ft. (2Ft. Above L.S.)
SCREEN DIAM. 1 1/2 inch
SCREEN SETTING 18-28 Ft.
SCREEN SLOT & TYPE 20 Slot PVC
WELL STATUS Monitoring

DEVELOPMENT

TEST DATA

STATIC DEPTH TO WATER 5.29 Ft. 3.68 Ft
DATE MEASURED 10-6-81 10-15-81
Measuring Point Top of PVC Pipe
Measuring Point Elevation 8.25 Ft.

DATE OF TEST
TYPE OF TEST
PUMP SETTING
SPECIFIC CAPACITY

FINAL PUMP CAPACITY
FINAL PUMP SETTING
AVERAGE PUMPAGE

WATER QUALITY

See Appendix

LITHOLOGY **REMARKS** SEE TABLE 1
A=Miscellaneous Fill Deposits
B=Dark Gray Organic Clay
C=Well sorted Sands Etc.
D=Silts, Clays Etc. (Glacial Till)

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5800 JERICHO TURNPIKE
SYOSSET, NEW YORK 11791

WELL LOG

PROJECT N 418 LD-1
CLIENT LCP Chemical Inc
DATE PREPARED 10-9-81 BY J. DeMartini

DEPTH, ft		DESCRIPTION EXISTING GRADE EL. 12.1 Ft.	L.S.
0 — #3.1	S.S.	Fill: Gravel and silt, Brown to Black; Slag and Traprock	A
#3.2	SS.	Fill: Medium Sand and Gravel: Yellow to Gray: Clean	A
		Clay, Gray-Black, Orange, Dry H2S Odor	B
10 — #3.3	S.S.	Clay, Gray, Black, Dry, Organic (Plant Material): Thin (1-2 inch) Layers of Brown Peat	B
#3.4	S.S.	As Above W/6 inch Peat Layer Base	B
20 — #3.5	S.S.	Sand, Fine to Medium, Gray, Wet Grading into Silty sands, Clays with Layers of Gray Organic Clay and Brown Peat and Red-Brown, Sandy Silt.	B-C
#3.6	S.S.	Sand, Fine to Medium, Red-Brown, Well Sorted with Poorly Sorted Gravelly Layers 2-6 inches Thich	C
30 — #3.7	S.S.	Clay, Silty, Dry, Cohesive	D
#3.8	S.S.	Clay, Stiff, Dry with Embedded Pebbles	D
40 — #3.9	S.S.	Dry Pebbles in Tight Clay Matrix	D
#3.10	S.S.	Clay, Dry, Silty with Pebbles	D
		Bedrock @ 47.5 Ft. Boring Stopped	

L. S. = Land Surface
- S. S. = Split Spoon Core Sample Number

OWNER LCP Chemicals Inc.
WELL NO. 3 State # 26-5295
LOCATION Lagoon Area
Linden, N.J. Plant
TOPO SETTING Filled Coastal Marsh
GROUND ELEV. 12.1 Ft.

DRILLING STARTED 10-1-81
DRILLING COMPLETED 10-1-81
DRILLER H.P. Drilling
TYPE OF RIG Drive Boring

WELL DATA

HOLE DIAM. 2 1/2 inch
FINAL DEPTH 30 Feet
CASING DIAM. 1 1/2 inch
CASING LENGTH 17 Ft. (2Ft. Above L.S.)
SCREEN DIAM. 1 1/2 inch
SCREEN SETTING 15-30 Ft.
SCREEN SLOT & TYPE 20 Slot PVC
WELL STATUS Monitoring

DEVELOPMENT

TEST DATA

STATIC DEPTH TO WATER 7.83 Ft. 7.72 Ft.
DATE MEASURED 10-6-81 10-15-81
PUMPING DEPTH TO WATER Low Tide High Tide
Measuring Point Top of PVC Pipe
Measuring Point Elevation 13.85 Ft.
DATE OF TEST
TYPE OF TEST
PUMP SETTING
SPECIFIC CAPACITY

FINAL PUMP CAPACITY
FINAL PUMP SETTING
AVERAGE PUMPAGE

WATER QUALITY

See Appendix

LITHOLOGY REMARKS SEE TABLE 1
A= Miscellaneous Fill Deposits
B= Dark Gray Organic Clay
C= Well sorted sands Etc.
D= Silts, Clays Etc. (Glacial Till)

SYOSSET, NEW YORK 11791

WELL LOG

PROJECT N 418 LD-1
CLIENT LCP Chemicals Inc.
DATE PREPARED 10-9-81 BY J. DeMartin

DEPTH, ft	DESCRIPTION EXISTING GRADE EL. 10.3 Ft.	L.S.
0 #4.1 S.S.	Fill, Redish Brown; sand and Gravel	A
#4.2 S.S.	Fill, Heterogengeous, Brown, Wet At Base	A
10 #4.3 S.S. / #4.4 S.S.	Much, wet, organic changing to dry organic clay with thin layers of brown Peat and Reeds; H2S Smell	A
20 #4.5 S.S.	Sand, Fine, Green, wet, Well Sorted Feldspathic wiht Organic materials present; H2S odor grades to Coarser; Brown at Bottom	C
#4.6 S.S. / 30 #4.7 S.S.	Clay, Red-Brown, Dry with Embedded pebbles	D
#4.8 S.S.	Clay, Red-Brown, Dry with Abundant Cobbles	D
40 #4.9 S.S.	Clay, Red-Brown, Dry and Pebbles in clay matrix in alternating layers	D
#4.10 S.S.	Clay, Dense, Dry with Siltstone Clasts	D
	Bedrock @ 48.5 Ft. Boring Stopped	

L.S. = Land Surface

-S.S.= Split Spoon Core Sample Number

OWNER LCP Chemical Inc.
WELL NO. 4 State # 26-5296
LOCATION Lagoon Area Linden, N.J. Plant
TOPO SETTING Filled Coastal Marsh
GROUND ELEV. 10.3 Ft.

DRILLING STARTED 10-1-81
DRILLING COMPLETED 10-1-81
DRILLER H. P. Drilling
TYPE OF RIG Auger

WELL DATA

HOLE DIAM. 8 inch.
FINAL DEPTH 38 Feet
CASING DIAM. 1 1/2 inch
CASING LENGTH 20 Feet (2' above L.S.)
SCREEN DIAM. 1 1/2 inch
SCREEN SETTING 18-38 Feet
SCREEN SLOT & TYPE 20 Slot PVC
WELL STATUS Monitoring

DEVELOPMENT

TEST DATA

STATIC DEPTH TO WATER 6.64 Ft 6.30 F
DATE MEASURED 10-6-81 10-15-81
Low Tide High Tide
Measuring Point Top of PVC pipe
Measuring Point Elevation 12.31 Ft.
DATE OF TEST
TYPE OF TEST
PUMP SETTING
SPECIFIC CAPACITY

FINAL PUMP CAPACITY
FINAL PUMP SETTING
AVERAGE PUMPAGE

WATER QUALITY

See Appendix

REMARKS

A= Miscellaneous Fill Deposits
B= Dark Gray Organic Clay
C= Well Sorted Sands Etc.
D= Silts, Clays Etc. (Glacial Till)

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SYOSSET, NEW YORK 11791

WELL LOG

PROJECT N 416 LD-1
CLIENT LCP Chemical Inc.
DATE PREPARED 10-9-81 BY J. DeMartini

DEPTH, ft		DESCRIPTION (EXISTING GRADE EL. 12.5 Ft.)	U.S.
0	5.1 S.S.	Fill: Bricks on top 1 ft. with clean brown sand and abundant traprock cobbles below	A
	5.2 S.S.	Fill: Loose, brown, silty sand with cobbles grading to loose grayish-brown silt and sand; wet at 11.8 Ft.	A
10	5.3 S.S.		
	5.4 S.S.	Sand, Silty, organic; dark grayish-brown with Molusck shells; moist	B-C
20	5.5 S.S.	Sand, grayish-Brown, moist with organic matter	C
	5.6 S.S.	Clay, moist, organic and dry, red-brown silty clay with pebbles	B
30	5.7 S.S.	Sand, silty, gray, organic, moist alternating with poorly sorted, red, wet, gravelly sands	C
	5.8 S.S.	Clay, red-brown, dry, stiff	D
40	5.9 S.S.	Red-Brown, pebbles gravel in clay matrix grading to a dry cobble and pebbles gravel	D
	5.10 S.S.	Bedrock @ 45 Ft. Boring Stopped	

OWNER LCP Chemical Inc.
WELL NO. S State #26-5297
LOCATION Lagoon Area Linden, N.J. Plant
TOPO SETTING Filled Coastal Marsh
GROUND ELEV. 12.5 Ft.

DRILLING STARTED 10-2-81
DRILLING COMPLETED 10-2-81
DRILLER H. P. Drilling
TYPE OF RIG Auger

WELL DATA

HOLE DIAM. 8 Inch
FINAL DEPTH 38 Feet
CASING DIAM. 1 1/2 inch
CASING LENGTH 8 Feet
SCREEN DIAM. 1 1/2 inch
SCREEN SETTING 8-38 Ft.
SCREEN SLOT & TYPE 20 Slot PVC
WELL STATUS Monitoring

DEVELOPMENT

TEST DATA

STATIC DEPTH TO WATER 5.99 Ft. 6.99 Ft.
DATE MEASURED 10-6-81 10-15-81
Low Tide High Tide
Measuring Point Top of PVC Pipe
Measuring Point Elevation 12.49 Ft.
DATE OF TEST
TYPE OF TEST
PUMP SETTING
SPECIFIC CAPACITY

FINAL PUMP CAPACITY
FINAL PUMP SETTING
AVERAGE PUMPAGE

WATER QUALITY

REMARKS

A= Miscellaneous Fill Deposits
B= Dark Gray Organic Clay
C= Well Sorted Sands Etc.
D= Silts, Clays Etc. (Glacial Till)

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BORING REPORT

SHEET 1 OF 1

DATE STARTED :	DATE FINISHED :	BORING No. MW6
CLIENT :		PROJECT No : 625-1

PROJECT NAME & LOCATION :

REMARKS:

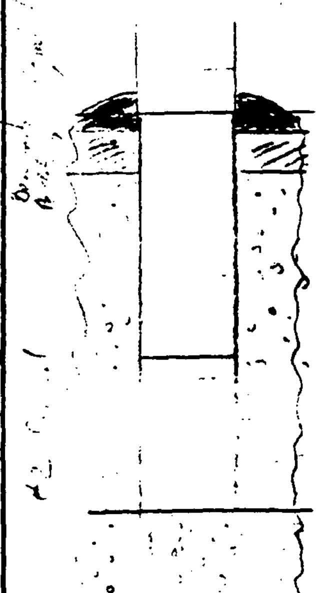
DRILLING CONTRACTOR :	DRILLER :	DRILLER :

EQUIPMENT :	CASING :	SOIL SAMPLER : SPLIT SPOON	SOIL SAMPLER :	CORE BARREL	AUGER	MON. WELL (MW) PIPE	MON. WELL (MW) CAP	DRILL RIG AND METHOD
TYPE :						P...		H...
SIZE :						4"		
HAMMER WT / FALL				BIT				

SURFACE ELEVATION :

SURFACE CONDITIONS :

WATER LEVEL AT FT. AFTER HRS. FT. AFTER HRS.

DEPTH BELOW GRADE	OVA READINGS	SAMPLE TYPE AND No.	SAMPLE DEPTH (FROM - TO)	BLOWS / 6" OR CORE TIME	STRATA DEPTH / ELEV.	DESCRIPTION AND REMARKS TRACE =0-10% LITTLE=10-20% SOME=20-30% AND=35-50%	MONITORING WELL CONSTRUCTION
					0	FILL, BN/GN, M-C SAND, COARSE PEBBLES, BRICK, CINDERS.	
5					5	C-PEBBLES W/SAND + SILT	
					6	ORGANIC MATL. (PEAT) W/BN/GN CLAY. STRONG SOLVENT-LIKE + H_2S ODOR.	
					10	EOB	

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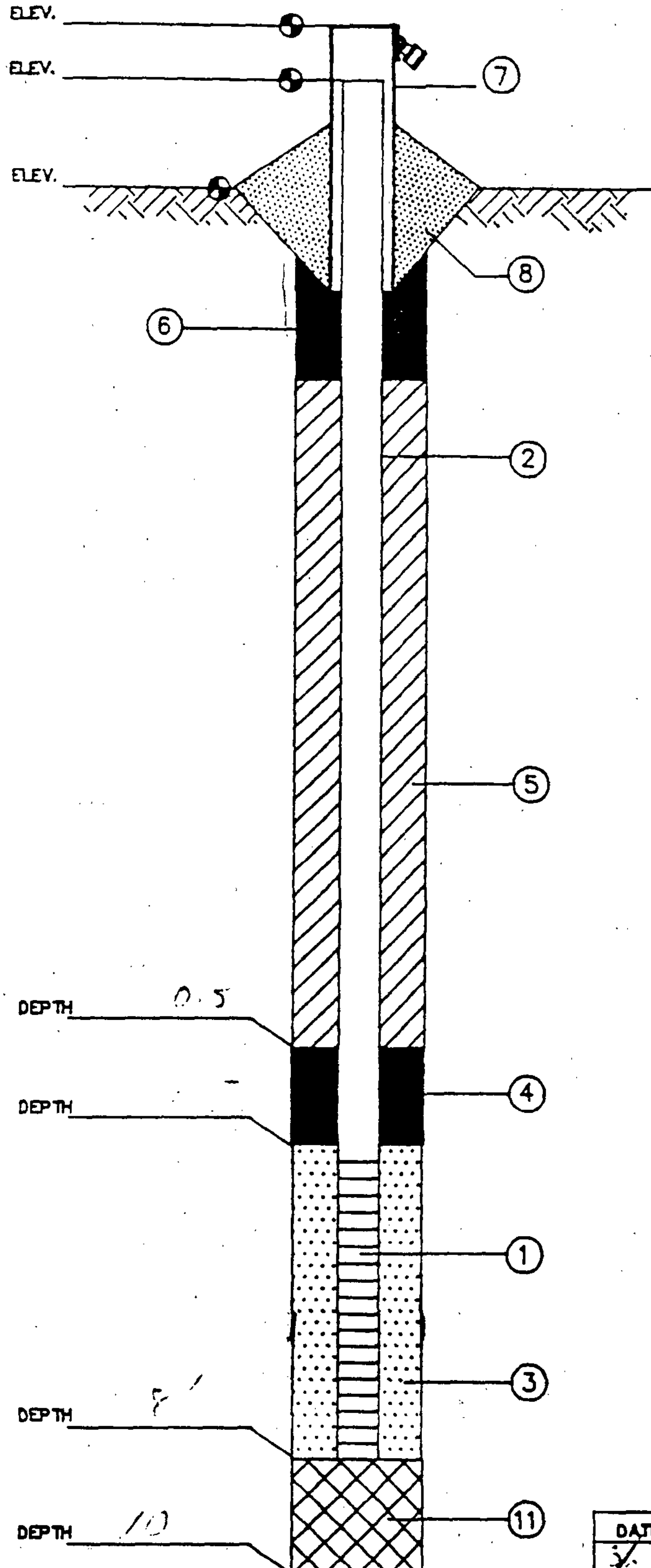
ALL DEPTHS MEASURED FROM GROUND SURFACE



eder associates consulting engineers,

MONITORING WELL CONSTRUCTION INFORMATION

JOB No. ______ CLIENT ______

LOCATION ______

DATE ______ WELL No. 6

HYDROGEOLOGIST ______

DRILLING CONTRACTOR ______

1.) SCREEN TYPE ______

SLOTTED LENGTH 5 ft

SLOT SIZE 10

2.) SOLID PIPE TYPE ______

SOLID PIPE LENGTH ______ ft

PIPE & SCREEN DIA. 4 in

JOINT TYPE – SLIP/GLUED ______ THREADED ✓

3.) TYPE OF BACKFILL AROUND SCREEN ______

4.) TYPE OF LOWER SEAL (IF INSTALLED) ______

5.) TYPE OF BACKFILL ______

HOW INSTALLED ______

6.) TYPE OF SURFACE SEAL (IF INSTALLED) ______

7.) PROTECTIVE CASING – YES ✓ NO ______

LOCKING CAP YES ______ NO ______

8.) CONCRETE SEAL – YES ✓ NO ______

9.) DRILLING METHOD ______

10.) ADDITIVES USED (IF ANY) ______

11.) TYPE OF BACKFILL ______

WATER LEVEL CHECKS *

DATE	TIME	DEPTH TO WATER	REMARKS
[illegible]	[illegible]	7.54	

* FROM TOP OF WELL CASING : PVC

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BORING | eder associates, consulting engineers p. c. | REPORT

85 FOREST AVENUE LOCUST VALLEY, N.Y. 11560
2317 INTERNATIONAL LANE MADISON, WI. 53704

SHEET 1 OF 1

DATE STARTED : [illegible]	DATE FINISHED : [illegible]	BORING No. MW 7
CLIENT : [illegible]		PROJECT No : 6[illegible]
PROJECT NAME & LOCATION : [illegible]		
REMARKS:		
DRILLING CONTRACTOR : [illegible]	DRILLER : [illegible]	DRILLER :

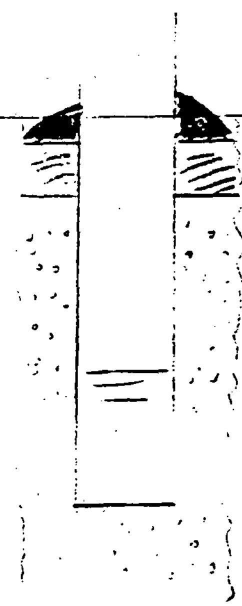
EQUIPMENT :	CASING :	SOIL SAMPLER : SPLIT SPOON		CORE BARREL	AUGER	MON. WELL (MW) PIPE	CAP	DRILL RIG AND METHOD
TYPE :						PVC		HSA
SIZE :						4"		
HAMMER WT / FALL				BIT.				

SURFACE ELEVATION :

SURFACE CONDITIONS :

WATER LEVEL AT FT. AFTER HRS. FT. AFTER HRS.

DEPTH BELOW GRADE	OVA READINGS	SAMPLE TYPE AND No.	SAMPLE DEPTH (FROM - TO)	BLOWS / 6" OR CORE TIME	STRATA DEPTH / ELEV.	DESCRIPTION AND REMARKS TRACE =0-10% LITTLE=10-20% SOME=20-30% AND=35-50%	MONITORING WELL CONSTRUCTION
0					0		
5						FILL, BN-GN M-C SAND W/ C-PEBBLES, CINDERS	
10					6	ORGANIC MATL. (PEAT) W/ GN CLAY, SOME F-M SAND. STRONG H2S ODOR.	
					10	EOB	



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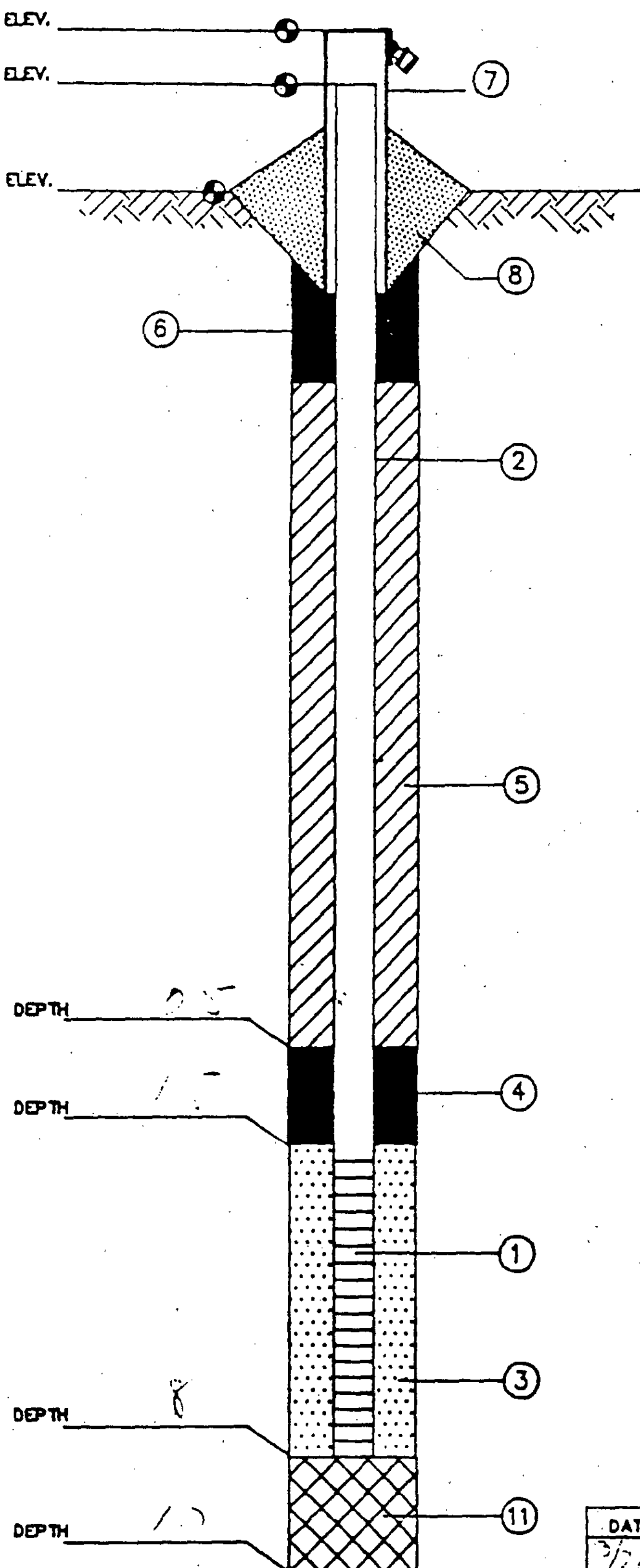
ALL DEPTHS MEASURED
FROM GROUND SURFACE



MONITORING WELL CONSTRUCTION INFORMATION

JOB No. ________ CLIENT ________

LOCATION ________

DATE ________ WELL No. 7

HYDROGEOLOGIST ________

DRILLING CONTRACTOR ________

1.) SCREEN TYPE ________

SLOTTED LENGTH 5 ft

SLOT SIZE ________

2.) SOLID PIPE TYPE P

SOLID PIPE LENGTH 5 ft

PIPE & SCREEN DIA. ________ In

JOINT TYPE – SLIP/GLUED ______ THREADED ______

3.) TYPE OF BACKFILL AROUND SCREEN ________

4.) TYPE OF LOWER SEAL (IF INSTALLED) ________

5.) TYPE OF BACKFILL ________

HOW INSTALLED ________

6.) TYPE OF SURFACE SEAL (IF INSTALLED) ________

7.) PROTECTIVE CASING – YES ✓ NO ______

LOCKING CAP YES ✓ NO ______

8.) CONCRETE SEAL – YES ✓ NO ______

9.) DRILLING METHOD ________

10.) ADDITIVES USED (IF ANY) ________

11.) TYPE OF BACKFILL ________

WATER LEVEL CHECKS *

DATE	TIME	DEPTH TO WATER	REMARKS
[illegible]	[illegible]	[illegible]	

* FROM TOP OF WELL CASING

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BORING REPORT

eder associates, consulting engineers p. c.
85 FOREST AVENUE LOCUST VALLEY, N.Y. 11560
2317 INTERNATIONAL LANE MADISON, WI. 53704

SHEET 1 OF 1

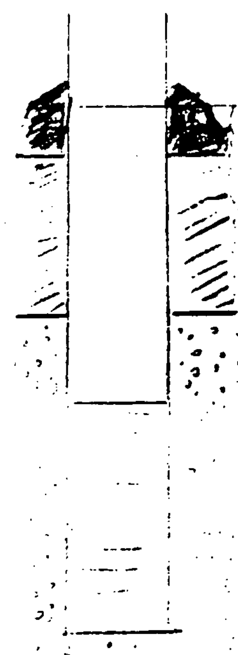
DATE STARTED : [illegible]	DATE FINISHED : [illegible]	BORING No. [illegible]
CLIENT : [illegible]		PROJECT No : [illegible]
PROJECT NAME & LOCATION : [illegible]		
REMARKS:		
DRILLING CONTRACTOR : [illegible]	DRILLER : [illegible]	DRILLER :

EQUIPMENT :	CASING :	SOIL SAMPLER : SPLIT SPOON	SOIL SAMPLER :	CORE BARREL	AUGER	MON. WELL (MW) PIPE	MON. WELL (MW) CAP	DRILL RIG AND METHOD
TYPE :						P[illegible]		[illegible]
SIZE :						[illegible]		
HAMMER WT / FALL				BIT.				

SURFACE ELEVATION :

SURFACE CONDITIONS :

WATER LEVEL AT FT. AFTER HRS. FT. AFTER HRS.

DEPTH BELOW GRADE	OVA READINGS	SAMPLE TYPE AND No.	SAMPLE DEPTH (FROM - TO)	BLOWS / 6" OR CORE TIME	STRATA DEPTH / ELEV.	DESCRIPTION AND REMARKS TRACE =0-10% LITTLE=10-20% SOME=20-30% AND=35-50%	MONITORING WELL CONSTRUCTION
0						FILL, BN-TN M-C SAND W/ C-PEBBLES, CINDERS.	
5							
10						ORGANIC MATL (PEAT) W/GN CLAY, SOME F-SAND. STRONG H_2S ODOR.	
						[illegible]	

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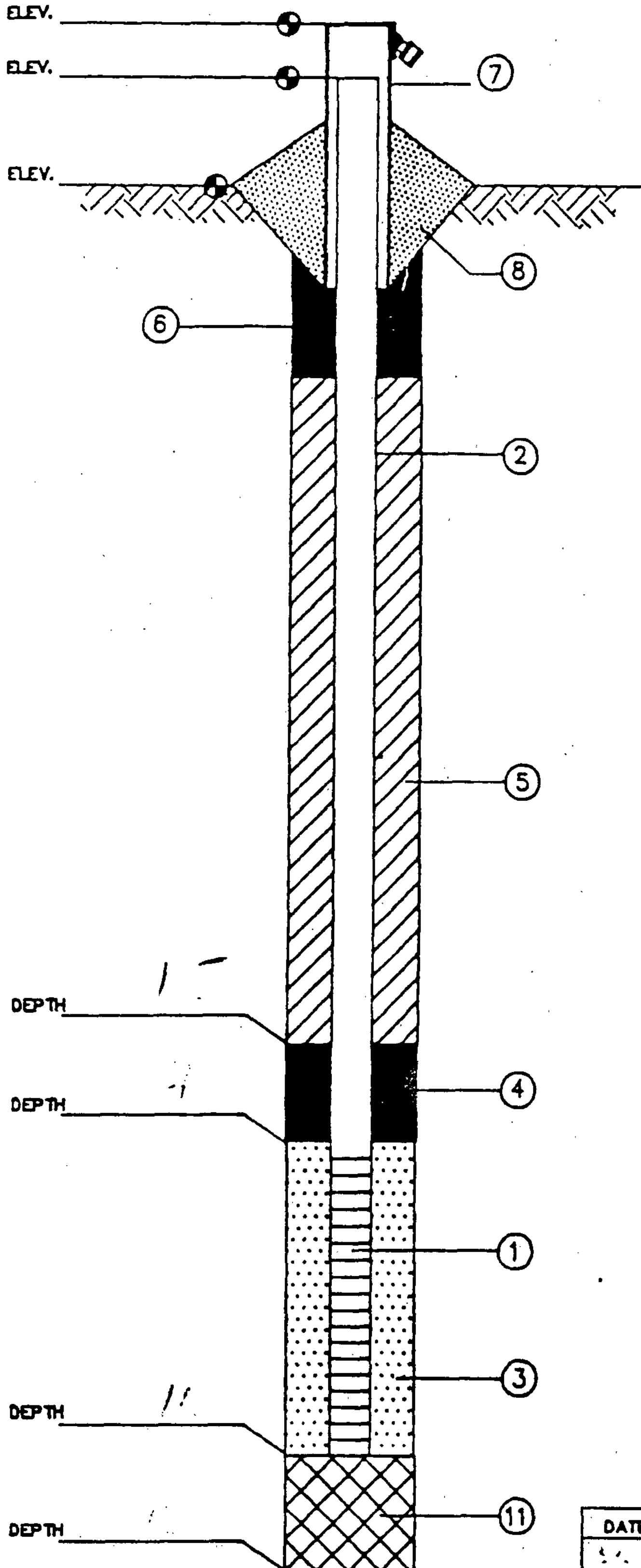
ALL DEPTHS MEASURED
FROM GROUND SURFACE



MONITORING WELL CONSTRUCTION INFORMATION

JOB No. ______ CLIENT ______

LOCATION ______

DATE ______ WELL No. 8

HYDROGEOLOGIST ______

DRILLING CONTRACTOR ______

1.) SCREEN TYPE ______

SLOTTED LENGTH 5 ft.

SLOT SIZE ______

2.) SOLID PIPE TYPE ______

SOLID PIPE LENGTH ______ ft.

PIPE & SCREEN DIA. 4 in

JOINT TYPE – SLIP/GLUED ______ THREADED ✓

3.) TYPE OF BACKFILL AROUND SCREEN ______

4.) TYPE OF LOWER SEAL (IF INSTALLED) ______

5.) TYPE OF BACKFILL —

HOW INSTALLED —

6.) TYPE OF SURFACE SEAL (IF INSTALLED) ______

7.) PROTECTIVE CASING – YES ✓ NO ______

LOCKING CAP YES ✓ NO ______

8.) CONCRETE SEAL – YES ✓ NO ______

9.) DRILLING METHOD ______

10.) ADDITIVES USED (IF ANY) ______

11.) TYPE OF BACKFILL —

WATER LEVEL CHECKS *

DATE	TIME	DEPTH TO WATER	REMARKS
[illegible]	[illegible]	[illegible]	

* FROM TOP OF WELL CASING

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BORING REPORT

eder associates, consulting engineers p. c.
85 FOREST AVENUE LOCUST VALLEY, N.Y. 11560
2317 INTERNATIONAL LANE MADISON, WI. 53704

SHEET 1 OF 1

DATE STARTED : 3/6/[illegible]	DATE FINISHED : 3/6/[illegible]	BORING No. [illegible] 9
CLIENT : [illegible]		PROJECT No : 6[illegible]-1

PROJECT NAME & LOCATION : [illegible]

REMARKS:

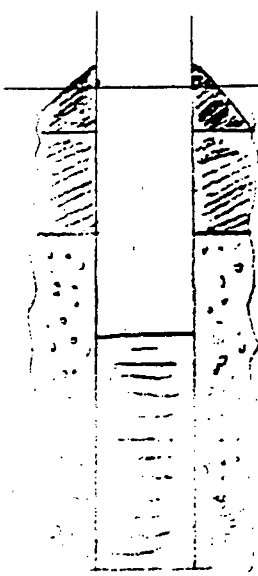
DRILLING CONTRACTOR : [illegible] DRILLER : [illegible] DRILLER :

EQUIPMENT :	CASING :	SOIL SAMPLER : SPLIT SPOON	SOIL SAMPLER :	CORE BARREL	AUGER	MON. WELL (MW) PIPE	MON. WELL (MW) CAP	DRILL RIG AND METHOD
TYPE :						[illegible]		HSA
SIZE :						[illegible]		
HAMMER WT / FALL				BIT				

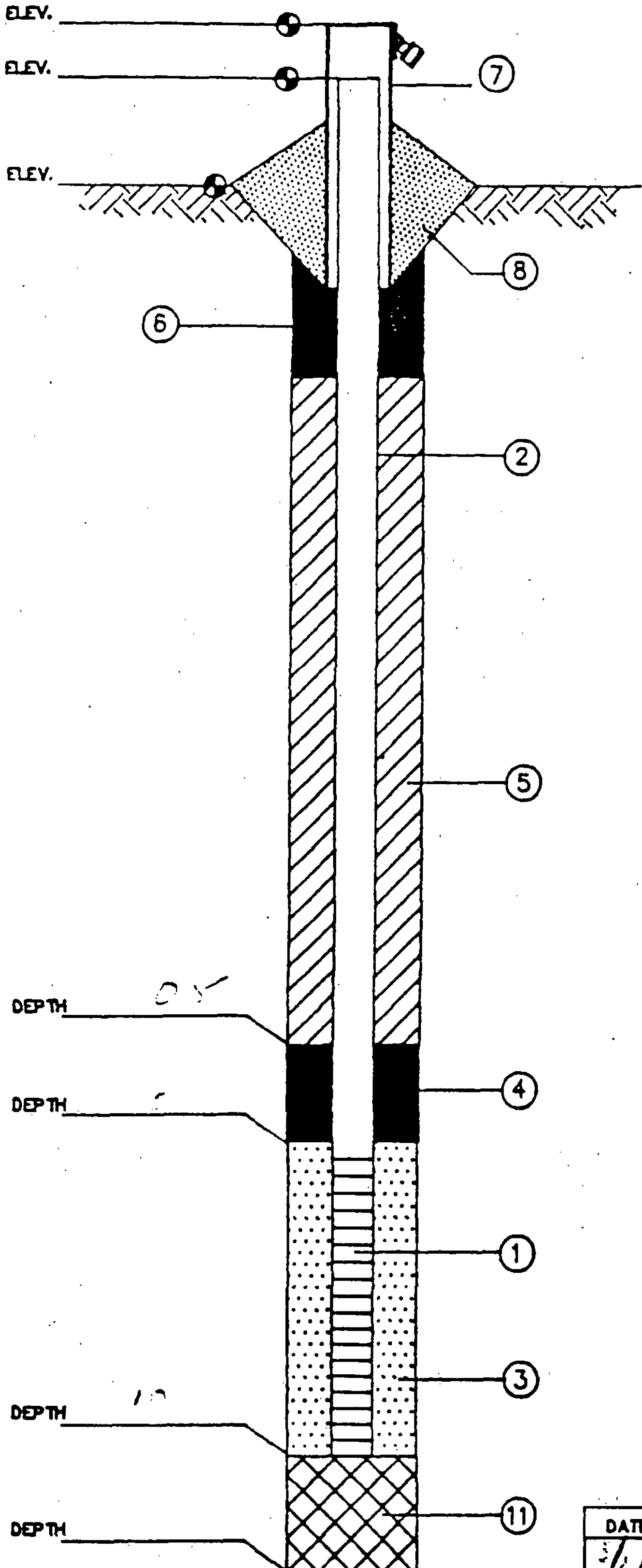
SURFACE ELEVATION :

SURFACE CONDITIONS :

WATER LEVEL AT FT. AFTER HRS. FT. AFTER HRS.

DEPTH BELOW GRADE	OVA READINGS	SAMPLE TYPE AND No.	SAMPLE DEPTH (FROM - TO)	BLOWS / 6" OR CORE TIME	STRATA DEPTH / ELEV.	DESCRIPTION AND REMARKS TRACE =0-10% LITTLE=10-20% SOME=20-30% AND=35-50%	MONITORING WELL CONSTRUCTION
0	—				0	FILL, BN/GN M-C SAND w/ C-PEBBLES, CINDERS	
5					5	GR F-M SAND, SILT, SOME C-PEBBLES	
					6	ORGANIC MATL (PEAT) W/GN CLAY, STRONG H2S ODOR,	
10					10	EOB	

ALL DEPTHS MEASURED
FROM GROUND SURFACE



Consulting Engineers,

MONITORING WELL CONSTRUCTION INFORMATION

JOB No. ______ CLIENT ______

LOCATION ______

DATE ______ WELL No. 9

HYDROGEOLOGIST ______

DRILLING CONTRACTOR ______

1.) SCREEN TYPE ______

SLOTTED LENGTH 5 ft

SLOT SIZE ______

2.) SOLID PIPE TYPE ______

SOLID PIPE LENGTH ______ ft.

PIPE & SCREEN DIA. ______ in

JOINT TYPE – SLIP/GLUED ______ THREADED ______

3.) TYPE OF BACKFILL AROUND SCREEN ______

4.) TYPE OF LOWER SEAL (IF INSTALLED) ______

5.) TYPE OF BACKFILL ______

HOW INSTALLED ______

6.) TYPE OF SURFACE SEAL (IF INSTALLED) ______

7.) PROTECTIVE CASING – YES ______ NO ______

LOCKING CAP YES ✓ NO ______

8.) CONCRETE SEAL – YES ✓ NO ______

9.) DRILLING METHOD ______

10.) ADDITIVES USED (IF ANY) —

11.) TYPE OF BACKFILL —

WATER LEVEL CHECKS *

DATE	TIME	DEPTH TO WATER	REMARKS
[illegible]			

* FROM TOP OF WELL CASING

LCP CHEMICALS -- NEW JERSEY, INC.
LINDEN, NEW JERSEY

Table A-1

Monitoring Well Elevation Data

Monitoring Well	Top of Casing Elevation
MW1	8.65
MW1A	10.32
MW2	7.66
MW3	13.39
MW4	11.28
MW5	11.57
MW6	10.30
MW7	9.61
MW8	11.72
MW9	12.62

Note: Top of casing elevations are in feet. Benchmark is southeast corner of sludge roaster pad.

APPENDIX B

LCP CHEMICALS - NEW JERSEY
FOOT OF SOUTH WOOD AVENUE
LINDEN CITY, UNION COUNTY, NEW JERSEY
EPA ID# NJD079303020

LCP owns a twenty-six (26) acre chemical manufacturing facility in Linden which is currently used exclusively for the storage and transfer of methylene chloride and caustic soda. GAF Corporation aquired the property in 1950 from the U.S. Government, filled an area of coastal wetlands on site, and developed it for production of liquid chlorine by the mercury cell process. LCP purchased the facility in 1972 from GAF and with a few minor modifications of the process continued chlorine manufacturing until September 1985. Other property within 1.5 miles is zoned for heavy industry (B.P. Oil, E.I. DuPont, GAF, Northville Industries) and transportation (New Jersey Turnpike). Also, Union Carbide operates the Linde Hydrogen Plant (LHP) as a tenant organization at the LCP Linden facility. Site security is adequately maintained by a perimeter chain link fence, a twenty-four (24) hour/day guard staff, and closed circuit TV cameras. Finished products are transported in bulk quantities via tank truck or rail car, and stored on site in three (3) aboveground tanks with a total combined volume of 1.02 million gallons.

The City of Linden is a densely populated urban area, such that, within three miles of the LCP facility an estimated 62,500 people were in residence as of December 1984. Linden is supplied with potable water by surface resevoirs located in Clinton, NJ approximately thirty miles to the west. The Arthur Kill, located almost 1100' off-site to the east is used for recreational boating and an endangered species, the Peregrine Falcon, is known to hunt in the salt marshes nearby.

LCP's Tremley Point Plant is situated directly upon a hetrogeneous fill material composed of sand, gravel, brick, and slag up to 10 or 15 feet thick. Bedrock occurs at 30 to 40 feet below grade and consists of a red sandy shale overlain by 10 to 15 feet of glacial deposits and 20 feet of organic silt, clay and peat. This portion of the New Brunswick Formation is not used as a potable aquifer within several miles of the facility due to the salt intrusion from the nearby coastal waters. LCP was provided all of its' potable and industrial water requirements (430,000 gallons/day when at full production in 1979) from the Elizabethtown Water Company. LCP does maintain five (5), NJPDES Discharge to Ground Water (DGW) permitted, monitoring wells which are screened in sand lenses of the glacial till and organic sediments. Within these wells the depth to water and salt concentrations vary according to the ebb and flow of the tides.

The "mercury cell process" yields chlorine gas through the electrolysis of a sodium chloride (brine) solution in the presence of metalic mercury. An amalgum of mercury and sodium is removed from the cell and used to hydrolize water forming sodium hydroxide and hygrogen gas (which are also comerically valuable). Metalic mercury was recovered and recycled in a brine purification process, but incompletely yielding a sludge residue.

LCP wastes included: mercury contaminated sludges. mercury vapors. spent lubricating oils, transformer oils, degreasing solvents, process wastewater, spill wash down, and stormwater runoff. LCP's tenant LHP purportedly does not generate any hazardous wastes. Mercury sludges were landfilled on-site in the Brine Sludge Lagoon for at least twenty (20) years, until 1982 when LCP began storing this waste in 55 gallon drums prior to shippment off-site. Mercury vapor emissions were discharged to the atmosphere from process equipment and an on-site sludge roaster under permits from the NJDEP DEQ Air Pollution Control Program. Spent lubracating oils. transformer oils, and degreasing solvents were stored in 55 gallon drums before shippment off-site for recovery. Process wastewater, stormwater runoff and spill wash-down from process equipment, the parking lot. and transfer areas was treated then discharged to the South Branch Creek. a tributary of the Arthur Kill (classified "Saline Estuarine waters. SE-2" by the Division of Water Resources).

Plant wastewater and sludges were collected in a 500,000 gallon agitated tank. The dilute slurry was pumped to a 140.000 gallon settling silo No. 4. The supernatant was directed to the effluent treatment system and the settled solids to the 4.500 gallon surge tank at the sludge roaster site. The brine sludge composition was reported by LCP on June 9, 1975 to be: 15 to 20 percent sodium chloride, 40 to 50 percent barium sulfate. 20 to 30 percent calcium carbonate and/or sulfate, 2 percent metal hydroxides. 2 percent dirt. and 100 to 500 ppm mercury. Settling silo No. 4, and the surge tank are no longer maintained at the Linden facility. The collection tank is in service only for emergency purposes as a holding tank for excessive volumes of stormwater.

Effluent treatment consists of pH neutralization, contact with activated carbon, and filtration. Prior to construction of the cooling towers (in 1980) NJPDES Discharge to Surface Water (DSW) permits limitations for temperature were exceeded regularly. Other infractions included occasionally alkaline pH and one major incident on August 20, 1979 when ten to twenty thousand gallons of mercury tainted brine was discharged to the South Branch Creek. An analysis of sediment samples from the creek (below LCP's discharge outfall), as reported by Geragthy and Miller Inc. February 1982, indicates that mercury is present at 46 ppm. LCP began recycling its process wastewater in 1982 and amended the DSW permit to reflect this change. Currently only stormwater runoff and spill wash down after treatment, are discharged.

AREAS OF CONCERN:
Enforcement personnel with the Division of Hazardous Waste Management reported evidence of numerous small releases observed during inspections in 1980, 81, 82, and 83.

9/17/80 Brine sludge was observed on the gravel near the 500,000 gallon "collection tank."

10/9/80 Brine sludge was observed on the gravel in the vicinity of "Settling Silo #4."

1/21/81 During the inspection a liquid was observed spewing from a cracked PVC pipe near the 500,000 gallon collection tank and the pump pit.

3/19/81 An acid spill (9' x 4') was noted on the soil near Building #220 and Avenue C.

10/22/81 A brine sludge slurry release from a transfer line was evidenced by a 1' x 15' spill area located on Avenue B between the pump pit and the Brine sludge Lagoon. Also, a 10' x 4' hydrochloric acid spill area was noted approximately 15' northwest of the 500,000 gallon collection tank.

11/19/81 The brine sludge slurry spill area noted on the previous inspection has expanded to cover a 125' x 30' area along the railraod tracks.

4/13/82 Sodium sulfide crystals were evident on the gravel surface in the pump pit area. Also noted was a salt spill at the railroad siding area.

8/5/82 Yellow crystals (probably sodium sulfide) was observed to cover a 10' x 15' area of broken asphalt near building #240.

2/28/83 Approximately two cubic yards of rubber liner from the caustic tank were deposited within the brine sludge lagoon in violation of the DEQ ACO.

Late in 1982, LCP paved the railroad siding and adjacent areas, the area under the salt silos, and sections of Avenue C.

In addition to the areas noted by DEP personnel a former employee of LCP has alleged several other sites of possible contamination.

1. The soil surface between the compressor building #231 and the railroad tracks received mercury contaminated sludge which was excavated from the Brine Sludge Lagoon.

2. Prior to OSHA requiring the repair of the cracked and broken concrete floor within the mercury cell Buildings #230 and #240, numerous spills were transmitted to the underlying soils.

3. The willful destruction of unfavorable laboratory analytical results from effluent sampling of the outfall to South Branch Creek may have obscured LCP's impact to the sediments and surface waters downstream of the facility.

The former owner (GAF Corporation) operated a Waste Water Treatment Plant (WWTP) at this facility, principally for pH neutralization, through the 1950's, 60's, and early 70's. Purportedly the site of this treatment system was paved over and is currently used to maintain an extensive electrical power transformer substation.

UNIT ANALYSIS:
There are four (4) Solid Waste Management Units (SWMU's) at the LCP facility in Linden. The "Brine" Sludge Lagoon" is the only RCRA regulated unit. The "Chem-Fix" Lagoon, the "Sludge Roaster", and the "Container Storage Area" (CSA) comprize the remaining three units. A RCRA part A permit application was submitted by LCP on August 13, 1980. Since the only TSD activity on-site (the Brine Sludge Lagoon) was certified closed in September 1985 the part B application was considered unnecessary in lieu of a post closure permit.

1. The Brine Sludge Lagoon was an unlined surface impoundment in which mercury contaminated sludges were disposed of for twenty (20) years or more. The lagoon was roughly a trapezium, approximately 275' x 200' x 220' x 80', and the accumulated waste volume estimated at 30,000 cubic yards. Analysis of the sludge in the lagoon was performed by the Princeton Testing Laboratories June 15, 1981 which indicated that mercury was present at 340 ppm.

   In order to preclude worker exposure to mercury vapors eminating from the disturbed surface of the Brine sludge and Chem-Fix lagoons during closure operations, the USEPA and NJDEP required LCP to suspend manufacturing and restrict access to the site from 1982 until 1984. Closure operations (concluded September 1985) included a clay cap, soil cover, grading, and seeding.

   Five (5) shallow NJPDES permitted wells monitor leachate releases to the phreatic surface. Quaterly reports of analysis from these wells indicate that concentrations of the metals: lead, chromium, cadmium, mercury, selenium, silver, and radium have exceeded permitted parameters on several occasions between 1982 and 1987. Elevated mercury levels detected in the soils from the monitor well borings (up to 500 ppm) and from the land surface (up to 1,500 ppm) are, according to a Geraghty and Miller Inc. report dated February 1982, "the result of present or prior land use" and "represent low solubility compounds of sulfides, phosphates, or carbonates."

   In a recently issued NJPDES DGW permit, four (4) additional wells are mandated in order to fully characterize the local water table and adequately monitor leachate from this unit. During the December 22, 1987 RCRA walk through site inspection conducted by personnel of the Bureau of Planning and Assessment, the HNu meter detected organic vapors eminating from the headspace of existing monitor wells P-1 and P-2. The NJPDES 30 year post closure monitoring program should be expanded to include an initial scan for priority pollutants and volatile organic compounds. Further investigation of this unit is unwarranted at this time.

2. The Chem-Fix Lagoon was a surface impoundment, used briefly in 1976 for experiments in stabilizing the mercury constituents of the brine sludge. This lagoon was roughly triangular, 60 to 80 feet on each side, with a total surface area of approximately 3,000 square feet. The lagoon dikes were constructed to a height of 8 feet with an earthern core and crushed stone cover. Two (2) 0.20 mil thick visquene plastic liners were installed in the lagoon which was also

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equipped with perforated under drain system for leachate collection. The lagoon contents, 460 cubic yards of treated brine sludge, was transfered to the Brine Sludge Lagoon in 1983. The Chem-Fix lagoon was subsequently excavated, filled, graded, and seeded. The proximity of the Chem-Fix Lagoon site to the Brine Sludge Lagoon site enables the NJPDES DGW permitted wells to monitor any leachate releases to the ground water from either unit. A further investigation of the Chem-Fix Lagoon is not warranted at this time.

3. The Sludge Roaster was designed and built in 1978 to vaporize mercury from steam dryed brine sludge, and thereby decontaminate the waste sufficiently to allow for final disposal at an off-site sanitary landfill. The roaster system was situated on a 16' x 40' concrete pad, one (1) foot thick, equipped with surface drainage channels (connected to the Waste Water Treatment Plant) and a cinder block curb. An Administrative Consent Order (ACO) issued September 1, 1981 required LCP to submit an application for a Hazardous Waste Facility (HWF) permit to operate the roaster unit. On June 30, 1982 the Bureau of Hazardous Waste Engineering (BHWE) denied the permit and LCP subsequently abandoned the process.

   A November 5, 1981 inspection by enforcement personnel of the Division of Environmental Quality, Air Pollution Control Program discovered a ruptured muffler plate on the sludge roaster that allowed excessive quantities of mercury vapors to be released to the atmosphere. Starting in 1985, this unit was dismantled and most of the components shipped to other LCP facilities around the country. No further investigation of the sludge roaster is warranted at this time.

4. The Container Storage Area (CSA) is a 300 square foot concrete pad, 1 foot thick with a 4 to 8 inch curb. Approximately 40 (55 gallon) drums or 2,000 gallons of waste: lubracating oils, transformer oils, disgreasing solvents, and dewatered brine sludges could have been stored on this unit at any one time. These wastes were shipped off-site for proper disposal within 90 days. During the recent RCRA walk through inspection (December 22, 1987) no containerized wastes were present at this unit, however the surface of the pad was covered with an absorbant material (speedy-dry) and some oily residues were noted on the gravel in the surrounding area. A limited investigation in the vicinity of the container storage area should be performed to determine the extent of contamination which may have occurred.

PERMITS:

NJPDES Discharge to Surface Water (DSW) permit #NJ0003778 grants LCP permission to discharge stormwater runoff and spill wash-down, after treatment, through one outfall to South Branch Creek (classified SE-3). This DSW permit was issued August 10, 1987 and is effective until April 30, 1991.

NJPDES Discharge to Ground Water (DGW) permit #NJ0003778 grants LCP permission to continue post-closure ground water monitoring of the wells surrounding the closed lagoons and to implement the modified Post-Closure Plan. "The potential discharge is leachate from the lagoon to the ground waters of the State, to the organic (marsh) deposits of recent geologic age, the Raritan-Magothy formation of the Cretaceous age, and the New Brunswick formation of the Jurassic age." The DGW permit was issued October 30, 1987 and is effective until November 29, 1992.

Air Pollution Control permit #044133 was issued on March 3, 1980 granting LCP permission to operate the Sludge Roaster System. This permit expired on October 5, 1982 well after LCP suspended operation of the roaster November 7, 1981.

Other Air Permits included:

PERMIT #	UNIT	EXPIRATION DATE
067418	Boiler Stack	2/17/89
020928	Pura-SIV stack	11/9/85
037033	Mercury Cell Destruct Tower	3/26/89
040435	Mercury Cell Destruct Tower	3/26/88
076056	Mercury Cell Destruct Tower	5/15/87
036994	HCL Scrubber	6/11/88
036993	HCL Scrubber	11/20/88
035067	HCL Scrubber	3/28/88

REGULATORY ACTIONS:

An Administrative Consent Order (ACO), was issued September 1, 1981 by the NJDEP Division of Environment Quality. The ACO required LCP to apply for a permit to operate the Sludge Roaster as a hazardous waste treatment facility, to submit bi-weekly progress reports of activities at the brine sludge lagoon, to submit applications for closure of the Chem-Fix Lagoon and the Brine Sludge Lagoon, and to fully evaluate all potential avenues of release to the ambient environment (ie. air monitoring, groundwater monitoring, soil boring, and surface water monitoring).

A Civil Administrative Penality of $17,500.00 was assessed against a former tenant at LCP, the Kuhne Chemical Company (KCC) in November 1981. KCC was issued a NJPDES permit #0027707 on September 9, 1974 to discharge uncontaminated, non-contact cooling water to the South Branch Creek. Analysis of effluent sampling from KCC's outfall, conducted January 1981, revealed extremely elevated concentrations of caustics and free chlorine (up to 124,430 ppm) and a correspondingly excessive alkaline pH. Aside from the obvious violation of permit parameters the DWR alleged KCC's discharge of waste materials was deliberate.

RECOMMENDATIONS:

Of the four SWMU's at LCP Chemicals in Linden only one unit, the CSA requires corrective action under the RCRA post closure permit program. A limited investigation to include soil sampling in the vicinity of the CSA is necessary to determine the nature and extent of contamination which may have resulted from past spill events.

The previously cited "Areas of Concern" which remain accessible, also require soil sampling to verify that adequate remediation was accomplished at the numerous, documented sites of small spills and past releases.

Currently an investigation of the Brine Sludge Lagoon and the Chem-Fix Lagoon is under the auspices of a NJDEP DWR thirty year, post closure ground water monitoring program. Considering of the longevity of the Brine Sludge Lagoon and the detected presence of VOC's in the well heads during the RFA-VSI, the NJPDES DGW permit should be modified to require an initial scan for priority pollutants and volatile organic compounds. Further investigation and/or corrective action under RCRA may be necessary at some future date pending results of the present survey.

The Sludge Roaster System concrete pad was intact and the nearby soils appeared unstained on December 22, 1987 during the RFA-VSI. A further investigation of this unit is unwarranted at this time.

All actions taken at this facility by the USEPA should be integrated with previous activities and closely coordinated with the NJDEP.

Submitted by:

Kenneth Conrow

Kenneth Conrow, HSMS IV
NJDEP, DHWM - BPA

I. DOCUMENTS REVIEWED

	DOCUMENT NAME	DATE	AUTHOR	LOCATION	NO. PAGES
1.	Waste Lagoon GW Monitoring	2/82	G&M Inc.	BGWQ	50
2.	Closure & Post Closure Plans	10/21/86	BHWE	BHWE	30
3.	GW, SW, & Sediment Sampling	1980-87	LCP INc.	BGWQ	200
4.	Review & Evaluation GW Monitoring	6/84	G&M Inc.	BGWQ	[illegible]
5.	Evaluation and Site Inspection	5/82	EPA Edison, NJ	EPA Edison, NJ	20
6.	Closure & Post Closure Plans	10/16/86	LCP	BHWE	50
7.	Closure & Post Closure Plans	8/84	BGWQ	BGWQ	80
8.	Closure Plan Chem-Fix Lagoon	10/81	LCP	BHWE	30
9.	Closure Approval	11/7/83	BHWE	BHWE	20
10.	Preliminary Report on Brine Sludge	6/9/75	Chem Fix Inc.	BHWE	20
11.	Sludge Roaster Plans & Sludge Analysis	1981/1982	LCP Inc.	BHWE	50
12.	Health & Inspect Statement	1981	LCP Inc.	BHWE	[illegible]
13.	Site Inspections	1980-83	DHWM Enforcement	Metro	200
14.	NJPDES Permits	10/87	BGWQ	BGWQ	100
15.	Report of telephone call	6/25/80	DHWM Enforcement	Metro	1
16.	Report of telephone call	1/25/81	DHWM Enforcement	Metro	1
17.	Report of telephone call	12/2/80	DHWM Enforcement	Metro	1
18.	Compliance Monitoring Report	5/78	DWR Enforcement	Metro	20

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I. DOCUMENTS REVIEWED

DOCUMENT NAME	DATE	AUTHOR	LOCATION	NO. PAGES
19. Compliance Monitoring Report	2/79	DWR Enforcement	Metro	25
20. ACO	9/1/81	DEQ Enforcement	Metro	20
21. Record of Violation	7/19/85	DEQ Enforcement	Metro	2
22. Discharge Report	2/7/79	DEQ Enforcement	Metro	1
23. Order	11/4/81	DEQ Enforcement	Metro	1
24. Investigation Summary	1/24/74	DEQ Enforcement	Metro	1
25. Complaint Form	1/27/81	DEQ Enforcement	Metro	1
26. Letter from LCP to EPA	3/20/87	LCP	Metro	1
27. Letter from LCP to DWR	4/24/87	LCP	Metro	1
28. Inspection Report, HRS	12/31/84	NUS Corp.	BPA	150
29. Georlogy and GW Resources, Union County	4/19/82	USGS	BPA	10
30. Letter from DFGW to NUS Corp.	11/15/84	DFGW	BPA	1
31. Air Permits	3/3/80	DEQ-BAPC	Metro	20
32. EPA Internal Memo	2/24/81	EPA-Region II	DWR, Metro	1
33. Administrative Penalty	10/7/81	DWR	DWR, Metro	30
34. NJPDES Permit	8/30/80	DWR	DWR, Metro	15

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II. OFFICES CONTACTED

	OFFICE	CONTACT	TELEPHONE #	CONTACT DATE
1.	BHWE	S. Wilson	(609) 292-9880	12/1/87
2.	BGWQM	J. Monroe	(609) 292-0424	12/3/87
3.	DHWM Metro Enforcement		(201) 669-3960	12/7/87
4.	DWR Metro Enforcement	T. Harrington	(201) 669-3900	12/8/87
5.	DEQ Air Program Enforcement		(201) 669-3935	12/8/87
6.	Linden Board of Health	H. Gaven	(201) 474-8409	12/11/87
7.	DCJ	P. Hayes	(609) 984-3900	12/11/87
8.	Flood Plain Management	P. Inverso	(609) 296-2373	12/14/87
9.	ORS		(609) 292-5697	12/14/87
10.	OEA	M. Ryon	(609) 292-8206	12/22/87
11.	USEPA		(201-321-6658	12/22/87
12.	DWR, Industrial Permits		(609) 292-0407	12/28/87

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RFA - VSI
LCP CHEMICALS - NEW JERSEY
LINDEN, UNION COUNTY
EPA ID# NJD097303020

NJDEP REPRESENTATIVES:

Mr. K. Conrow, HSMS IV (609) 984-3018
Ms. D. Gaffigan, HSMS III (609) 984-3239
3228

AIR MONITORING EQUIPMENT:

HNu SN 62419
OVA SN 50371

LCP CHEMICALS - NEW JERSEY REPRESENTATIVES:

Mr. K. DeVoe, Plant Manager, (201) 862-1666

DATE OF INSPECTION: December 22, 1987

SWMU	OBSERVATIONS
Brine Sludge Lagoon	HNu readings at Monitor Wells: P-1 P-2 5 ppm* 40 ppm Span 2 6-7 ppm 5 ppm* Span 9.8
Chem - Fix Lagoon	No evidence of a release
Sludge Roaster	No evidence of a release
Container Storage Area	Gravel in the vicinity appeared coated with a oily residue.

* Denotes HNu readings after the monitor well cap was removed for several minutes.

AREAS OF CONCERN:

	AOC	OBSERVATIONS
A.	500,000 gallon Collection Tank	No evidence of a release
B.	Silo #4	No evidence of a release
C.	Avenue B	No evidence of a release
D.	Pump Pit	No evidence of a release

E. Along Rail Road Tracks	No evidence of a release
F. Between Building #231 and the Rail Road Tracks.	No evidence of a release

TOPICS DISCUSSED:

TENANT ORGANIZATIONS:
The Union Carbide, Linde Hydrogen Plant does not generate or store hazardous wastes.

The Kuehne Chemical Company which vacated the premises in February 1981 allegedly dumped chlorinated wastes (spent bleach) and caustics into the South Branch Creek on a daily basis.

PRIOR LAND USE:
Before development by the GAF Corporation in the 1950's and 60's, this parcel of property was predominantly a coastal marshland.

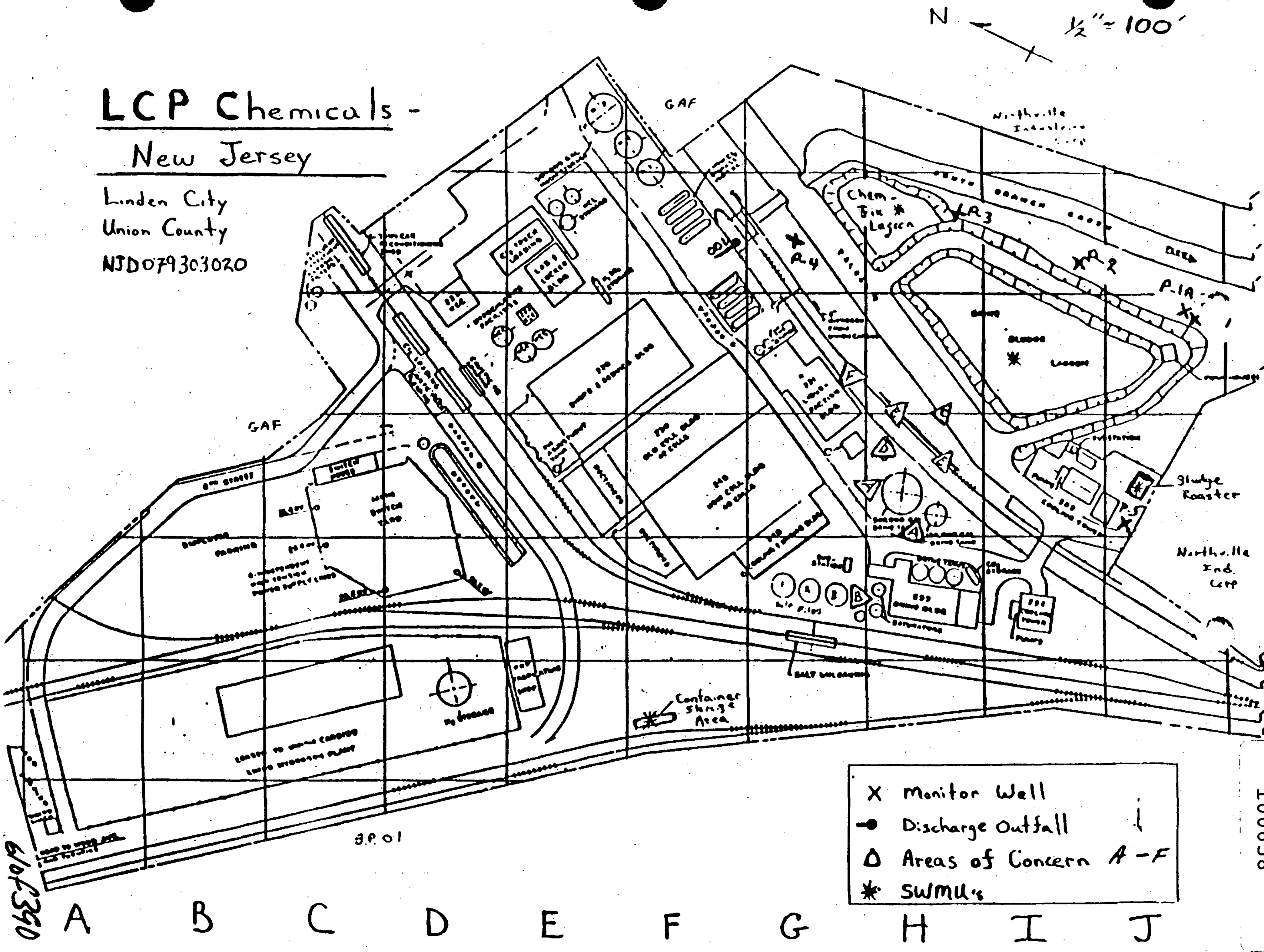
The former GAF Waste Water Treatment Plant was located at the present site of the electrical power transformer station. Wastewater treatment consisted of pH neutralization before discharge to the South Branch Creek.

CURRENT ACTIVITIES ON-SITE:
Two 500,000 gallon tanks are used to store sodium hydroxide, and one 20,000 gallon tank for methylene chloride. At the time of this inspection these storage vessels were reported as empty.

Process equipment is currently being dismantled and shipped off-site for use at other LCP facilities across the country.

LCP Chemicals -
New Jersey

Linden City
Union County
NJD079303020



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RCRA FACILITY ASSESSMENT

FOR RCRA CORRECTIVE ACTION PROGRAM

FACILITY: LCP Chemicals - New Jersey

ADDRESS: Foot of South Wood Ave.

Linden, Union County, NJ

EPA ID# NJD079303020

N.J. DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF HAZARDOUS WASTE MANAGEMENT
BUREAU OF PLANNING & ASSESSMENT

PREPARER: Kenneth Conrow

DATE: January 8, 1988

GENERAL INFORMATION PAGE

EPA

RCRA FACILITY ASSESSMENT
FOR RCRA CORRECTIVE ACTION PROGRAM

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NJ	D079303020

II. SITE NAME AND LOCATION

01 SITE NAME	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER				
LCP Chemicals - New Jersey	Foot of South Wood Avenue				
03 CITY	**04 STATE**	**05 ZIP CODE**	**06 COUNTY**	**07 COUNTY CODE**	**08 CONG DIST**
Linden	NJ	07036	Union		

09 COORDINATES LATITUDE 74° 12' 30" N LONGITUDE 40° 36' 19" W BLOCK: 587 LOT: 3.01, 3.02, 3.03 ACREAGE: 25.83

directions to site:
Take the NJ Turnpike North to Exit 13 then Route 278 west to Edgar Road and make a left turn onto South Wood Avenue. LPC is on the left just after the turnpike overpass.

III. RESPONSIBLE PARTIES

01 OWNER	02 STREET		
LCP Chemicals and Plastics Inc.	P.O. Box 484		
03 CITY	**04 STATE**	**05 ZIP CODE**	**06 TELEPHONE NUMBER**
Linden	NJ	07036	(201) 862-1666
07 OPERATOR	**08 STREET**		
LCP Chemicals - New Jersey			
09 CITY	**10 STATE**	**11 ZIP CODE**	**12 TELEPHONE NUMBER**
Linden	NJ	07036	(201) 862-1666

13 TYPE OF OWNERSHIP (Check one)
☒ A. PRIVATE ☐ B. FEDERAL: ______ (Agency name) ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL
☐ F. OTHER: ______ (Specify) ☐ G. UNKNOWN

IV. INSPECTION INFORMATION/site characterization

01 DATE OF INSPECTION	02 SITE STATUS	03 YEARS OF OPERATION
12 ,22 ,87 (MONTH DAY YEAR)	☐ ACTIVE ☒ INACTIVE	1950 / 1985 (BEGINNING YEAR / ENDING YEAR) ___ UNKNOWN

04 TYPE OF SITE (Check all that apply)
☐ A. STORAGE ☒ B. TREATMENT ☒ C. DISPOSAL ☐ D. UNAUTHORIZED DUMPING ☐ E. OTHER ______ (Specify)

05 SUMMARY OF KNOWN PROBLEMS

1. Leachate from the Brine Sludge Lagoon has exceeded NJPDES discharge to groundwater parameters for metals.
2. Gravel in the vicinity of the Container Storage Area is coated with an oily residue.

06 SUMMARY OF ALLEGED OR POTENTIAL PROBLEMS

A former employee alleged:
1. The destruction of unfavorable analytical results,
2. Unauthorized dumping of mercury contaminated wastes on-site,
3. Unreported releases of mercury containing substances,

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V. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)		03 TELEPHONE NUMBER	
Jill Monroe	NJDEP, DWR		(609) 292-8427	
04 PREPARED BY	**05 AGENCY**	**06 ORGANIZATION**	**07 TELEPHONE NUMBER**	**08 DATE**
Kenneth Conrow	NJDEP	DHWM-BPA	(609) 984-3018	1, 8, 88

BASIC PROCESS/UNIT CHARACTERISTICS

UNIT	NUMBER OF UNITS	AMOUNT/ SIZE	RCRA/ NJPDES STATUS	UNIT ~~EXHIBITING~~ OBSERVED/ SUSPECTED/NO RELEASE
A. LANDFILL				
B. SURFACE IMPOUNDMENT	2	30,900 cu. yds. 3,000 sq. ft.	RCRA/NJPDES NJPDES	Suspected Suspected
C. WASTE PILE				
D. LAND TREATMENT UNIT				
E. INJECTION WELL				
F. INCINERATOR				
G1. ABOVEGROUND TANKS				
G2. UNDERGROUND TANKS				
H1. CONTAINER STORAGE UNIT	1	300 sq. ft.	None	Suspected
I1. OTHER	1	640 sq, ft,	None	No Release
I2. OTHER				
I3. OTHER				
I4. OTHER				

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DESCRIPTION OF HAZARDOUS CONDITIONS & WASTE CHARACTERISTICS

SWMU	LOCATION	DESCRIPTION
Brine Sludge Lagoon	H,I,J-2,3	An RFI may be required pending results of the current investigation initiated by the NJDEP DWR. A 30 year post closure ground water monitoring program to include four new wells and quarterly reporting is part of the recently issued NJPDES DGW permit. Groundwater monitoring from 1980 to 1987 has revealed that the concentrations of metals often exceeded permit parameters. Leachate from this unit may impact the groundwater of the State, although the New Brunswick formation is not used as a potable source within several miles of LCP. Reference Attachments: I and J.
Chem-Fix Lagoon	G,H-2	An RFI may be required pending results of the current investigation initiated by the NJDEP DWR. The proximity of the Chem-Fix Lagoon and Brine Sludge Lagoon sites enables the NJPDES permitted wells to monitor leachate releases to the groundwater from either unit. Monitoring from 1980 to 1987 has revealed that the permit parameters for metals were often exceeded. Leachate from this unit may impact the groundwater of the State. Within several miles of LCP, the New Brunswick Formation is not used as a potable water supply. Attachments: I,J.
Sludge Roaster	J-4	An RFI is not required at this unit. During the RFA-VSI conducted December 22, 1987 the concrete pad was intact, and the nearby soils appeared unstained. The Sludge Roaster System was disassembled in 1985 and most of its component parts were shipped off-site. Reference RFA-VSI.

DESCRIPTION OF HAZARDOUS CONDITIONS & WASTE CHARACTERISTICS

SWMU	LOCATION	DESCRIPTION
Container Storage Area	F-6	A limited RFI to include soil

sampling in the vicinity of the CSA is necessary to determine the nature and extent of possible contamination. During the RFA-VSI conducted December 22, 1987 the surface of the pad was covered with an absorbant material (Speedy-Dry) and an oily residue was noted on the gravel in the surrounding area. Past releases at this unit may impact the soils of the State. Reference RFA-VSI.

CONSLUSIONS AND RECOMMENDATIONS

I. CONCLUSIONS

01 Identify all SWMU's which have a "No Release" determination and do not require an RFI.

Sludge Roaster

02 Identify all SWMU's which have had documented releases to the environment and require an RFI.

Brine Sludge Lagoon
Chem - Fix Lagoon

03 Identify all SWMU's which require further investigation for a "No Release" determination.

Container Storage Area

The above conclusions and recommendations are accepted for purpose of the completion of RCRA facility Assessment requirements.

Signed: DATE

Kenneth Conser [illegible]
Preparer

DHWM/BHWE

DHWM - BHWP

DWR

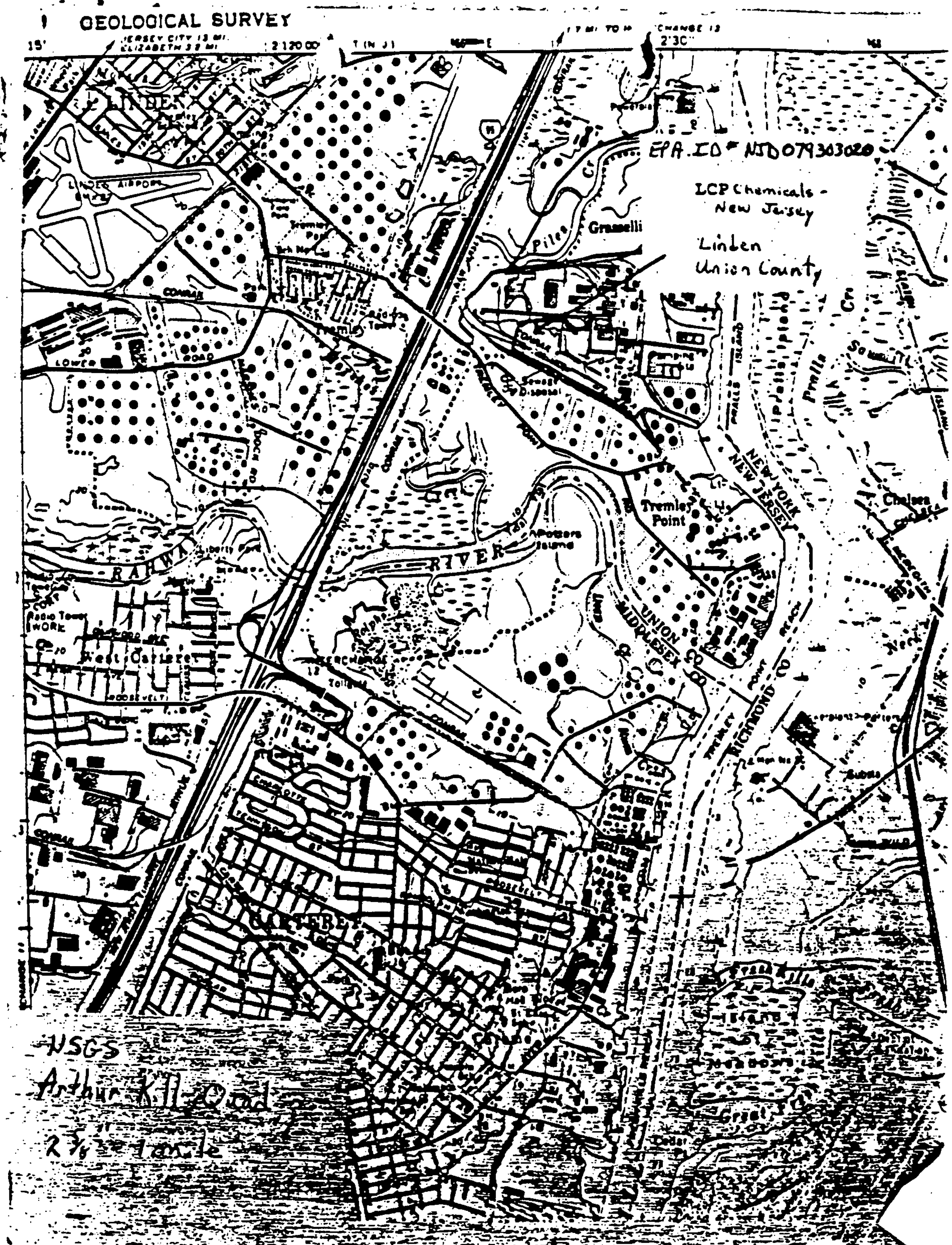
LCP CHEMICALS - NEW JERSEY
FOOT OF SOUTH WOOD AVENUE
LINDEN CITY, UNION COUNTY, NEW JERSEY
EPA ID# NJD079303020
ATTACHMENTS

MAPS

USGS, ARTHUR KILL QUADRANGLE	
HAGSTROM, UNION COUNTY ROAD MAP	
HAGSTROM, UNION COUNTY ROAD MAP	(5 MILE RADIUS)
CITY OF LINDEN, TAX MAP	
NJ ATLAS, BASE MAP	(4 MILE RADIUS)
NJ ATLAS, GEOLOGIC OVERLAY	(4 MILE RADIUS)
NJ ATLAS, WATER SUPPLY OVERLAY	(4 MILE RADIUS)
NJ ATLAS, GEOLOGIC AND WATER SUPPLY OVERLAY	(4 MILE RADIUS)
NJGS, CASE INDEX SITES AND WATER WITHDRAWAL POINTS	(1 and 5 MILE RADIUS)

ATTACHMENTS:

A.	DEQ, ADMINISTRATIVE CONSENT ORDER	9/1/81
B.	DEQ, AIR POLLUTION CONTROL PERMIT #044133	3/3/80
C.	LCP, HAZARDOUS WASTE FACILITY REGISTRATION SLUDGE ROASTER	11/19/81
D.	DEP, AIR POLLUTION DISPERSION MODEL	7/21/81
E.	DEQ, ORDER	11/5/81
F.	RECON SYSTEMS INC., AIR SAMPLING REPORT	6/15/81
G.	LCP, LETTER	9/1/81
H.	LCP, PRELIMINARY REPORT ON BRINE SLUDGE	6/9/75
I.	DWR, DISCHARGE TO GROUND WATER PERMIT #NJ0003778	10/30/87
J.	LCP, GROUND WATER MONITORING	1982 TO 1987
K.	DWR, DISCHARGE TO SURFACE WATER PERMIT #NJ0003778	8/10/87
L.	LCP, NONCOMPLIANCE REPORTS	6/75, 1/79, 8/79
M.	EPA, DISCHARGE TO SURFAVE WATER PERMIT #NJ0027707	8/31/80
N.	DWR, CIVIL ADMINISTRATIVE PENALTY	10/7/81
O.	NUS CORP., SITE INSPECTION AND HRS MODEL	12/31/84
P.	DHWM, FACILITY INSPECTIONS	1980 TO 1983
Q.	DOH, STREAM OR WASTE WATER ANALYSIS	1978, 1980
R.	DEP, MEMO "TIP FROM A FORMER LCP EMPLOYEE"	1/25/81


GEOLOGICAL SURVEY
EPA ID # NJD079303020
LCP Chemicals - New Jersey
Linden Union County
Grasselli
Tremley Point
RIVER
NEW YORK
NEW JERSEY
UNION CO
MIDDLESEX CO
RICHMOND CO
West Carteret
Chelsea
USGS
Arthur Kill Quad
2 3/8 = 1 mile

Union County
New Jersey

N

SCALE IN FEET (Approximate)
0 1000 2000 3000 4000 5000

NJD079303020

LCP Chemicals & Plastics, Linden Union

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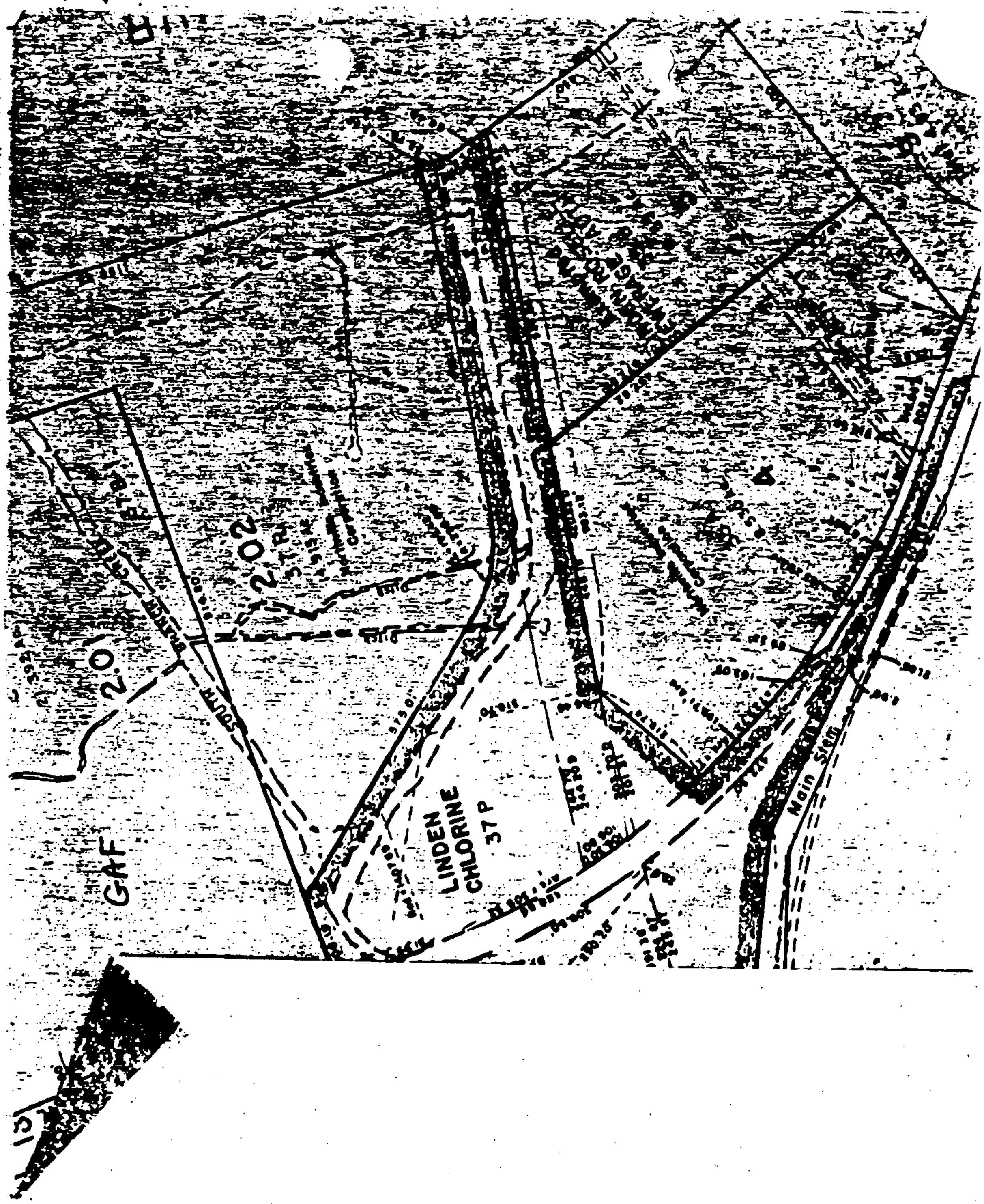
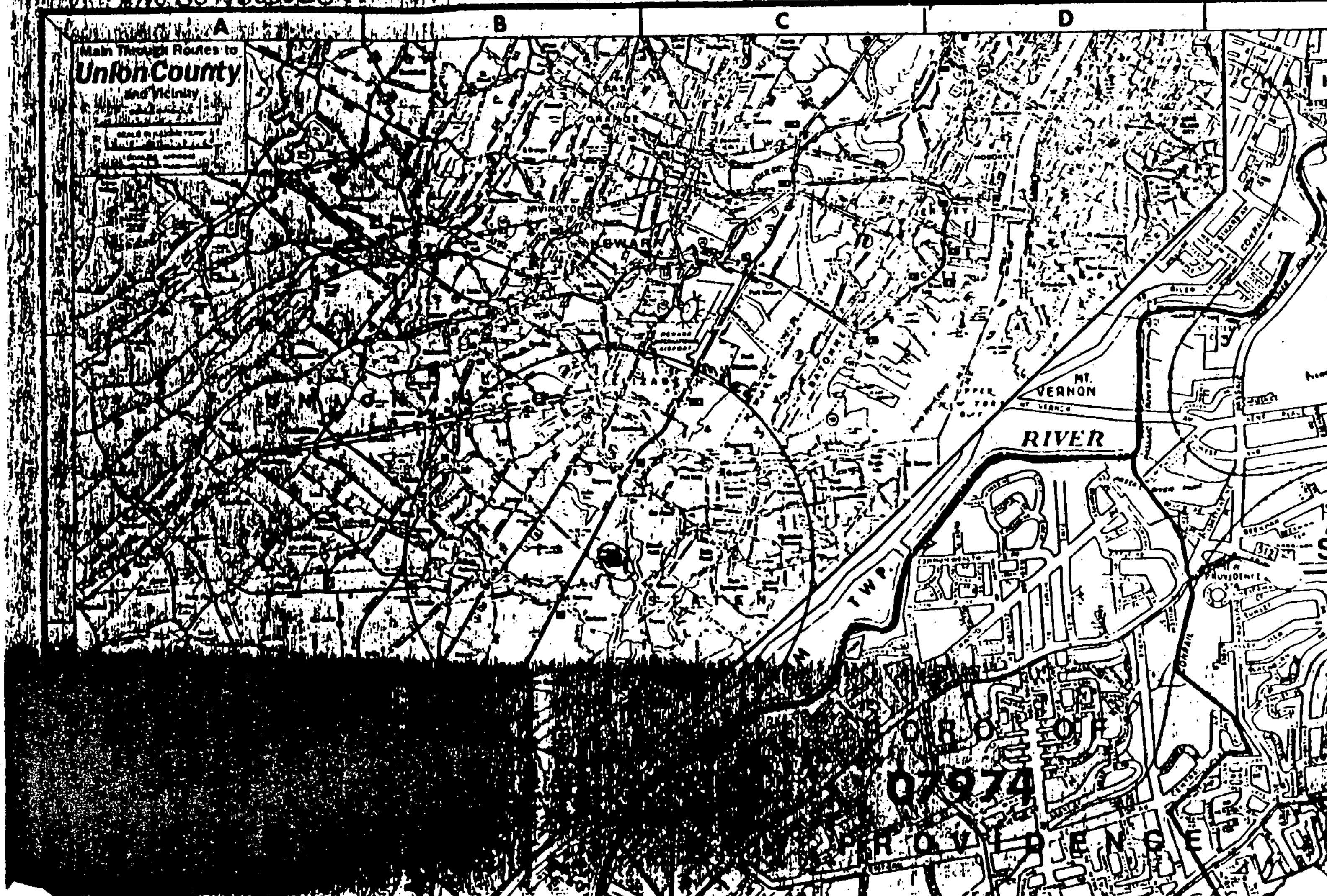

LINDEN
CHLORINE
37 P
GAF
Main Stem

LCP-Chemicals - New Jersey Linden



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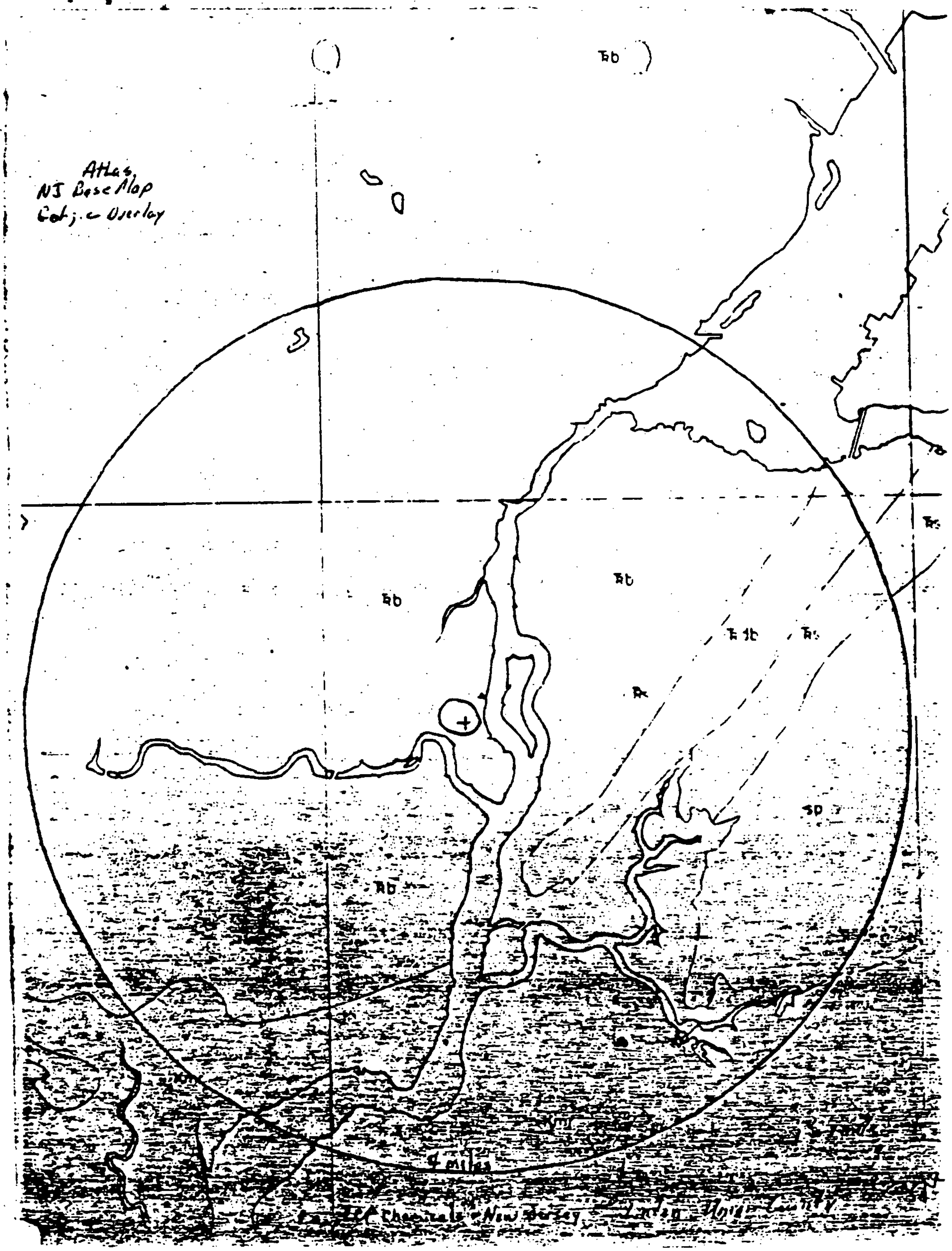
LCP Chemicals - NJ
Linden, Union County
NJD 079303020
ATLAS
Base Map
ROSSVILLE
CHELSEA
BULLS HEAD



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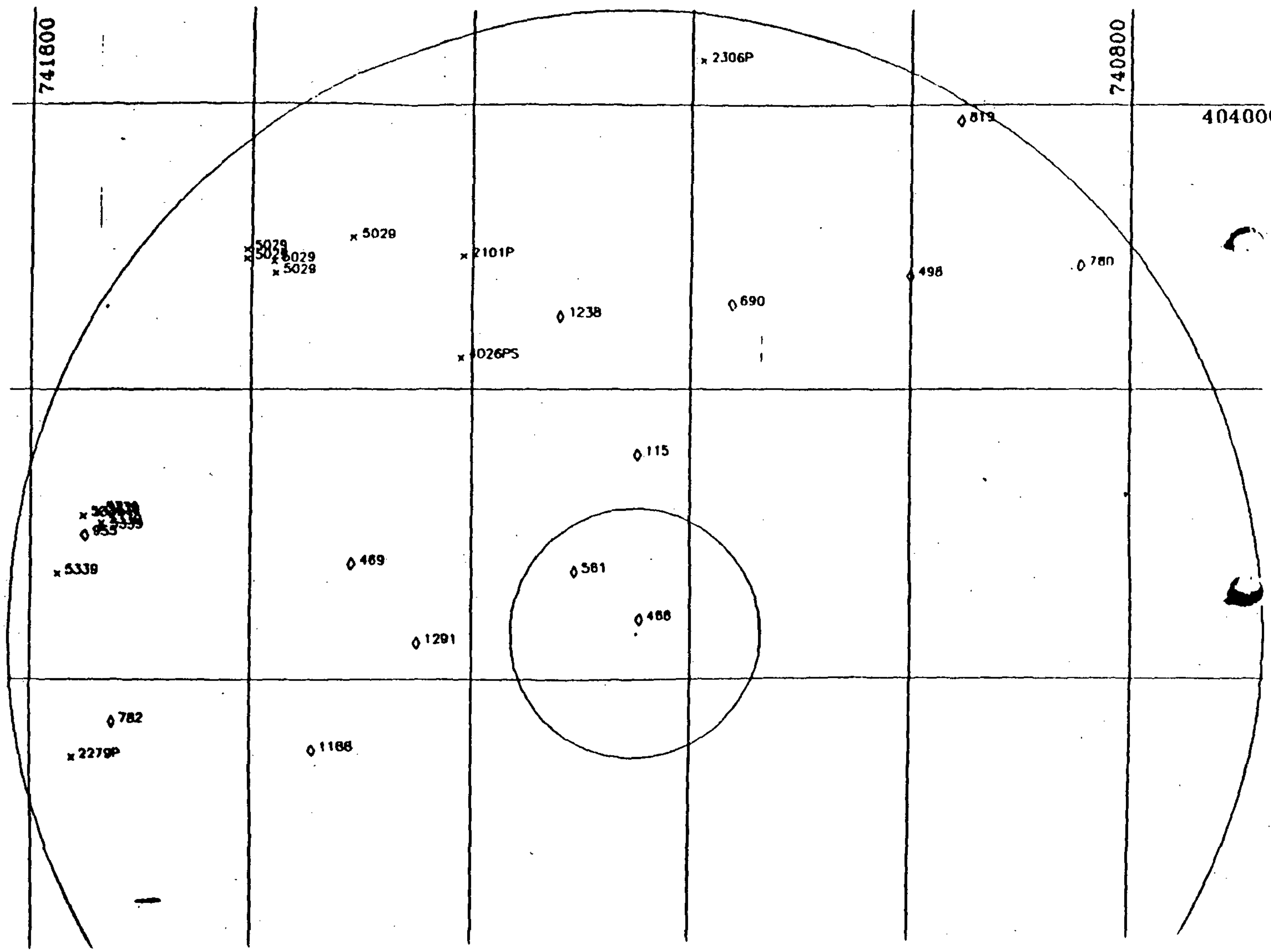
SUBJECT TO REVISION

WATER WITHDRAWAL POINTS AND NJGS CASE INDEX SITES WITHIN 5.0 MILES OF:

LATITUDE 403619
LONGITUDE 741230

DRAFT

SCALE: 1:63,360
(1 Inch = 1 Mile)



× WATER WITHDRAWAL POINTS
◊ NJGS CASE INDEX SITES
1 MILE AND 5 MILE RADII INDICATED

NJGS CASE INDEX DATA RETRIEVED FROM:
NEW JERSEY GEOLOGICAL SURVEY
ON 12/22/87

100672

NJGS CASE INDEX
SITES WITHIN
5.0 MILES OF:

LATITUDE 403619
LONGITUDE 741230

DRAFT

SCALE: 1:63,360
(1 Inch = 1 Mile)

× WATER WITHDRAWAL POINTS
◊ NJGS CASE INDEX SITES
1 MILE AND 5 MILE RADII INDICATED

NJGS CASE INDEX DATA RETRIEVED FROM:
NEW JERSEY GEOLOGICAL SURVEY
ON 12/22/87

PLOT PRODUCED BY:
NJDEP
DIVISION OF WATER RESOURCES
BUREAU OF WATER ALLOCATION
CN-029
TRENTON, NJ 08625
DATE: 02/02/88

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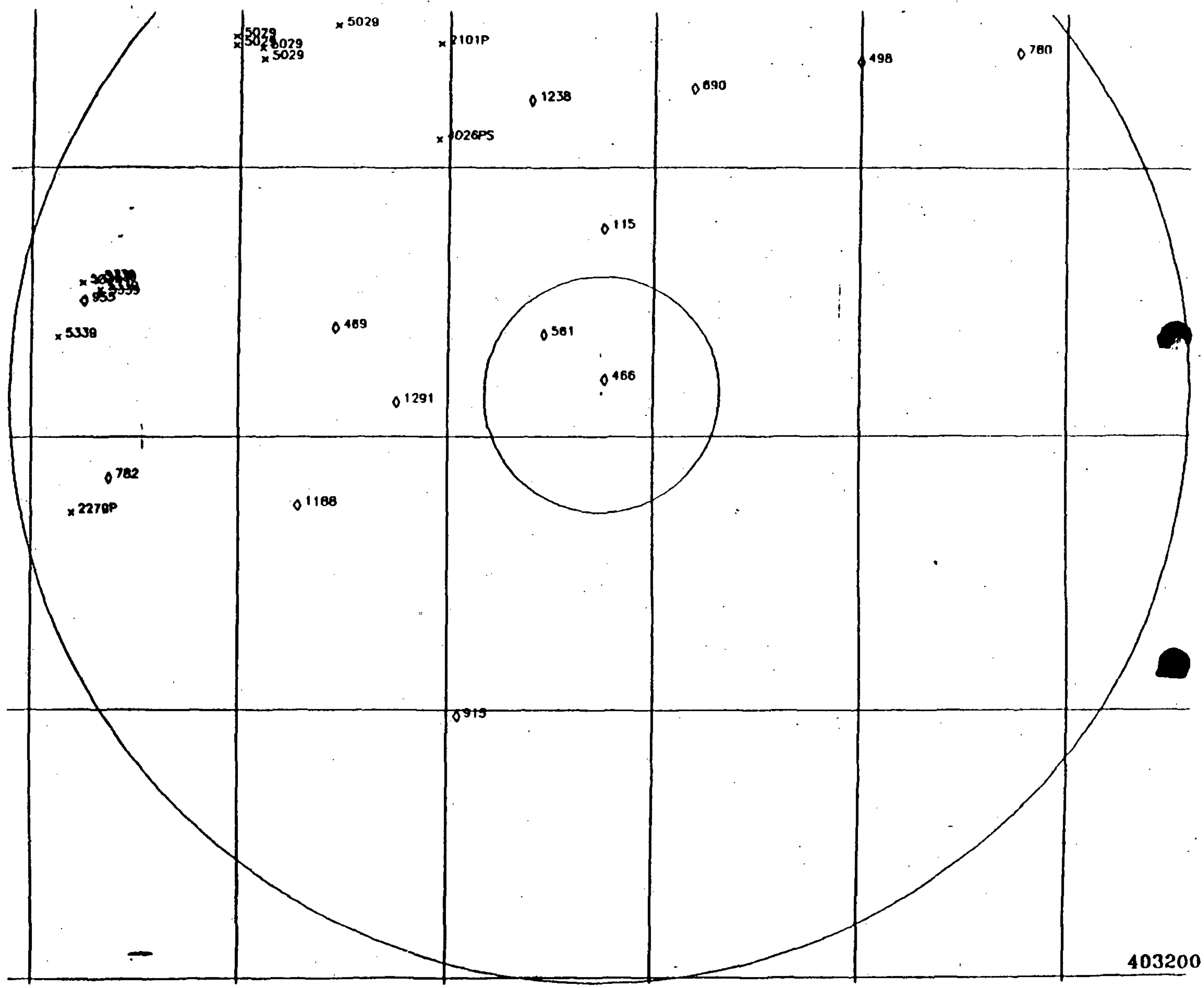
SUBJECT TO REVISION



100673

Page 1 of NJGS CASE INDEX SITES WITHIN 5.0 MILES OF 403619 LAT. 741230 LONG AS OF [illegible] IN ORDER BY SITE NUMBER [illegible]

SITENUM	NAME	LAT	LON	DISTANCE	CONTAM	PMCODE1	PMCODE2	STATUS1	STATUS2
113	EXXON REFINERY, BAYWAY LINDEN, UNION CO.	[illegible]	741209	1.4	1	103	3070	9	[illegible]
466	LINDEN CHLORINE, LINDEN, UNION CO.	403625	741228	0.1	56	3070	0	9	
469	SOLVENTS RECOVERY SERVICE, LINDEN, UNION CO.	[illegible]	741505	[illegible]	1	130	3070	9	
498	CONRAIL E-PORT, ELIZABETHPORT, UNION CO.	[illegible]	741000	[illegible]	1	103	130	[illegible]	
561	GAF CORP., LINDEN, UNION CO.	403645	741301	0.7	[illegible]	100	3070	9	
590	CHEMICAL CONTROL, ELIZABETH, UNION CO.	403535	[illegible]	2.7	0	[illegible]	3070	[illegible]	[illegible]
780	DISCOVERIES, INC, BAYONNE, HUDSON CO.	403851	740527	4.6	[illegible]	[illegible]	3050	1	[illegible]
782	DRI-PRINT FOILS, INC, RAHWAY	403542	741715	4.2	0	0100	3070	1	
819	NOUDEX, INC - ELIZABETH PLANT, UNION CO.	403953	[illegible]	4.8	00	0103	0100	1	[illegible]
915	DISTRIGAS, PORT READING, MIDDLESEX CO.	403737	741354	3.0	00	[illegible]	2090	1	[illegible]
995	RAHWAY WATER DEPT., RAHWAY, UNION CO.	[illegible]	[illegible]	4.4	00	3070	0	1	[illegible]
1168	SIMTH TRANSFER CORP., [illegible] ENGLEHARD AVE., WOODBRIDGE, MIDDLESEX CO.	403530	741526	2.7	[illegible]			[illegible]	
1278	CONVERTERS INC, LINDEN, UNION CO.	403830	[illegible]	[illegible]	[illegible]	3070		1	[illegible]
1291	GULF PRODUCTS CO.-LINDEN TERMINAL, UNION CO.	403615	741430	1.8	[illegible]	[illegible]	3070	1	[illegible]

Number of Observations: 14

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Page 1 of PRELIMINARY SURVEY OF WATER WITHDRAWAL POINTS WITHIN 5.0 MILES OF 403519 LAT. 741270 LON. IN ORDER BY PERMIT NUMBER - [illegible]

NUMBER	NAME	SOURCEID	LOCID	LAT	LON	LLACC	DISTANCE	COUNTY	MUN	DEPTH	GEOL	[illegible]	CAPACITY
2101P	DECORATOR PLASTICS, INC.	2604727		[illegible]	741405		[illegible]	39	04	570	GTRB		200
2279P	VOLCO BRASS & COPPER COMPANY	2600049	1	[illegible]	[illegible]		4.6	39	03	[illegible]	GTRB		300
2306P	HAYWARD MANUFACTURING PRODUCTS	2604713	1	404019	741154		4.6	39	[illegible]	274	GTRB		100
4026PS	EXXON COMPANY USA	MORSES	CREEK	403813	741406	T	2.6	39	07		SY		
5029	ELIZABETHTOWN WATER COMPANY	2602393	CHANDLER	403903	741305	F	[illegible]	[illegible]	14	[illegible]	GTRB		300
	ELIZABETHTOWN WATER COMPANY	2602702	WALABURGA1	[illegible]	[illegible]	F	4.3	39	14	330	GTRB		300
	ELIZABETHTOWN WATER COMPANY	2602360	WALABURGA2	403546	741547	F	4.0	39	14	340	GTRB		200
	ELIZABETHTOWN WATER COMPANY	2602412	WALABURGA3	403558	741603	F	4.3	39	14	321	GTRB		300
	ELIZABETHTOWN WATER COMPANY	2602463	WALABURGA4	[illegible]	741548	F	4.1	39	14	[illegible]	GTRB		450
5339	RAHWAY, CITY OF	2600361	1	403710	741723		4.4	39	13	50.5	GOSD		300
	RAHWAY, CITY OF	2600380	2	[illegible]	[illegible]		4.4	39	13	51.5	GOSD		300
	RAHWAY, CITY OF	2600724	3	403708	741731		4.5	39	13	76	GTRB		350
	RAHWAY, CITY OF	2601671	4	[illegible]	741721		4.3	39	13	[illegible]	GTRB		400
	RAHWAY, CITY OF	[illegible]	5	[illegible]	741720		[illegible]	39	13	[illegible]	GTRB		400
	RAHWAY, CITY OF	2603795	6	[illegible]	[illegible]		4.6	39	13	[illegible]	GTRB		400

Number of Observations: 15

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State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL QUALITY
JOHN FITCH PLAZA. CN 027. TRENTON. N. J. 08625

(IN THE MATTER OF)
(LINDEN CHEMICALS & PLASTICS, INC.)

ADMINISTRATIVE CONSENT ORDER

The following ADMINISTRATIVE CONSENT ORDER is issued pursuant to the authority vested in the Commissioner of the New Jersey Department of Environmental Protection (hereinafter "the Department") and duly delegated to the Director, Division of Environmental Quality, pursuant to his authority under the Solid Waste Management Act, N.J.S.A. 13:1E-1 et seq.

FINDINGS

1. Linden Chemicals & Plastics, Inc. (hereinafter "LCP" or "the company") located in the City of Linden, County of Union, and State of New Jersey has been and is continuing to operate a Hazardous Waste Facility (hereinafter "brine sludge lagoon") by lagooning mercury contaminated brine sludge at the LCP Linden Plant, being more specifically described as Lot 3 of Block 587 on the Tax Map of the City of Linden.

2. LCP also has another lagoon containing mercury contaminated sludge located on the above specified premises, known as the Chem-fix lagoon, which was used for test purposes for four days in 1976 and has not since been operated.

3. LCP has constructed and operated from time to time a mercury brine sludge roaster designed to recapture and recycle the useful mercury portion of this waste.

ORDER

NOW, THEREFORE, by mutual agreement of the parties hereto, Linden Chemicals & Plastics, Inc., is HEREBY ORDERED to undertake the following remedial measures with respect to its Linden Plant's hazardous waste disposal practices:

100676

Attachment A
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until the Department completes its review of the brine sludge lagoon closure plan to be submitted by LCP in accordance with the terms of paragraph #4. This authorization for continued use of the existing on-site brine sludge lagoon is expressly contingent upon the environmental evaluation, to be conducted by the company, conclusively showing that the operation and maintenance of the brine sludge lagoon will not cause significant adverse impacts to the ambient air, waters or soils of New Jersey over this period of time or in the future.

(4) Whether the decision is affirmative or negative, LCP, upon receipt of the Department's final decision on said roaster application, shall by no later than 45 days thereafter submit to the SWA an application for the proper, final closure of the existing brine sludge lagoon. Said closure plan, signed and sealed by a licensed New Jersey Professional Engineer, shall provide for the final disposition of all wastes previously deposited into this on-site brine sludge lagoon either by total secured entombment or by complete excavation for ultimate disposal in a manner approved by the Department. Should LCP propose closure of this brine sludge lagoon via permanent entombment, the company must provide sufficient revenues placed into an escrow account to allow for a monitoring system for the legally required period of time to be used to verify the continuous integrity of said full containment system. The closure plan shall be reviewed and evaluated in accordance with the requirements of all applicable federal and State regulations governing such facilities.

(5) By no later than 45 days from the date of the execution of this agreement, the company shall submit to the SWA an application for the proper, final closure of the Chem-fix lagoon, which closure plan shall be prepared in accordance with all the requirements as specified hereinabove in paragraph four.

(6) In order to fully evaluate all potential avenues of mercury and other metals release into the ambient environment from the operation and maintenance of the aforesaid on-site brine sludge lagoon, LCP shall undertake forthwith the following monitoring program, which shall include but not necessarily be limited to below listed tasks:

a. ambient air monitoring in all down wind areas of the on-site brine lagoon to measure for mercury emissions from said waste stockpile. The mobile air monitoring device shall be approved in advance by the DEP and be calibrated to record mercury levels in nanograms per cubic meter of air;

b. modeling calculations to verify that the on-site brine sludge lagoon's trenching system and pile configuration has sufficient capacity (both presently and after installation of an impervious cover) to fully contain the rain water run-off to be generated by a 100 year frequency storm;

c. installation of a sufficient number of groundwater monitoring wells as required to fully delineate the impacts, if any, of the brine sludge lagoon upon the soils and waters situated in the vicinity of this waste stockpile, in addition to evaluating potential impacts upon any surface waters of the State of New Jersey. Twin or cluster well installations shall be drilled where necessary to obtain screen access to all different water bearing zones in the aquifer. (In all instances where such twin or cluster well installations are placed, short well screens will be utilized with the exact length to be determined by the type and thickness of the geological formation encountered. In order to ensure that these wells do not provide avenues for downward migration of contaminants, all casings shall be cement grouted to the ground surface immediately after installation. DEP well drilling specifications shall be strictly adhered to except wherein site related modifications are approved in writing by the DEP's Bureau of Groundwater Management).

d. a soils boring protocol and water sampling routine as required to obtain a determination of whether the brine sludge lagoon and/or the chem-fix lagoon has or is presently contaminating the ground or surface waters of the State of New Jersey by release of any of the pollutants presently contained therein. Said protocol and routine shall encompass preparation of a water chemistry map and soils permeability calculations -- taken at a minimum of every five foot depth and at every change in the lithology utilizing split spoon sampling techniques -- in all areas of the LCP Linden premises potentially impacted by either the brine sludge lagoon or the chem-fix lagoon.

Should the aforesaid evaluation determine that such contamination has or is occurring, then the company shall prepare a groundwater contour map as part of its program to delineate the full extent of the contamination of these soils and waters and the direction of its migration, if any;

e. all stream sediment samples shall be obtained at several depths beginning at the surface and continuing until the sampling instrument meets substantial resistance. At least one composite soil sample shall be obtained from a minimum of six separate locations in the vicinity of the roaster. All soil samples shall be analyzed by the company for mercury content by dry weight total mercury content;

f. all surface water samples shall be obtained at low tide and both surface and groundwater samples shall be obtained as split samples and analyzed by the company for total mercury content by wet weight. The duplicate sample shall be retained by the company for subsequent analysis by a certified private laboratory at its sole cost should confirmation be deemed warranted in the discretion of the Department. All wells shall also be sampled at least once for the presence of calcium carbonate, barium sulfate, iron hydroxide, calcium sulfate conductivity and pH, in accordance with the aforesaid analytical protocol where applicable;

g. the purging and bailing procedures for all monitoring wells shall be approved by the Department in advance and a representative of the DEP shall be on-site for the commencement of the soils boring program and thereafter at his discretion;

h. the elevations to sea level of the tops of all the monitoring wells shall be determined by a New Jersey licensed surveyor.

i. no later than 30 days after completion of the aforesaid evaluation, all findings and data generated thereby shall be provided to the Department in writing, along with recommendations for all further monitoring as deemed necessary to complete the requirements as set forth in paragraph d.

RESERVATION OF RIGHTS

(7) It is expressly understood and AGREED by the parties hereto that the execution of this Administrative Consent Order does not waive any rights or obligations of either of them to protect the environment from pollution emanating from the industrial activities of LCP as required by all applicable State, federal and local laws, rules and regulations. Nor does it obviate LCP's obligations to comply with all State, federal and local laws, rules and regulations pertaining to these activities conducted at its Linden facility, with the sole exception of the SWA's registration requirements which shall be complied with as set forth hereinabove.

(8) LCP and the DEP hereby consent and agree to comply with all the terms and provisions of this Administrative Consent Order, which shall be fully enforceable in the Superior Court of New Jersey and also may be enforced in the same fashion as an Administrative Order issued pursuant to N.J.S.A. 13:1E-1 et seq.

(9) LCP hereby waives its right to an administrative hearing on the subject matter of this Order.

Christopher Hansen
President
Linden Chemicals & Plastics, Inc.

Date: Issued September 1, 1988

John J. Stanton, Director
Division of Environmental Quality
Department of Environmental Protection

100680

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Form VEM-022 T
1/79

100681

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF ENVIRONMENTAL QUALITY
BUREAU OF AIR POLLUTION CONTROL

PERMIT TO CONSTRUCT, INSTALL OR ALTER CONTROL APPARATUS OR EQUIPMENT AND CERTIFICATE TO OPERATE CONTROL APPARATUS OR EQUIPMENT (STACK TESTS REQUIRED)

Permit and Certificate Number 0 4 4 1 3 3 DEP Plant ID 4 0 3 2

(Mailing Address)

LCP Chemicals - New Jersey Incorporated
Foot of South Wood Avenue
Linden, NJ 07036

(Plant Location)

SAME

Union County

Applicant's Designation of Equipment Pilot sludge roaster and dryer

N.J. Stack No. 0 0 9 No. of Stacks 0 1 No. of Sources 0 0 2

Approval 3 (Mo.) 3 (Day) 80 (Year) Start Up ___ (Mo.) ___ (Day) ___ (Year) Expiration 10 (Mo.) 05 (Day) 82 (Year)

THIS PERMIT AND TEMPORARY CERTIFICATE IS BEING ISSUED UNDER THE AUTHORITY OF CHAPTER 106, P.L. 1967 (N.J.S.A. 26:2C-9.2). THE TEMPORARY CERTIFICATE WILL ALLOW FOR INSPECTION, EVALUATION, AND TESTING TO ASSURE CONFORMANCE WITH THE PERMIT AND WITH ALL OTHER PROVISIONS OF TITLE 7, CHAPTER 27, OF THE NEW JERSEY ADMINISTRATIVE CODE.

BEFORE A PERMANENT CERTIFICATE IS ISSUED, YOU WILL BE REQUIRED TO: (SEE OTHER SIDE)

1. CONDUCT STACK TESTS IN ACCORDANCE WITH N.J.A.C. 7:27-8.4 (c).
2. OBTAIN APPROVAL OF THE TEST PROCEDURES. SUBMIT A DETAILED DESCRIPTION OF THE SAMPLING PORT LOCATIONS, SAMPLING EQUIPMENT, AND SAMPLING AND ANALYTICAL PROCEDURES FOR SUCH TESTS TO: SUPERVISOR, TECHNICAL SERVICES SECTION, BUREAU OF AIR POLLUTION CONTROL, 380 SCOTCH ROAD, TRENTON, NEW JERSEY 08628, (609) 292-7641.
3. NOTIFY THE APPROPRIATE FIELD OFFICE (SEE OTHER SIDE) AT LEAST 48 HOURS PRIOR TO THE ACTUAL TESTING.
4. SUBMIT TWO COPIES OF THE TEST RESULTS TO THE PERMITS AND CERTIFICATES SECTION. TEST RESULTS MUST BE CERTIFIED BY A NEW JERSEY LICENSED PROFESSIONAL ENGINEER OR BY A CERTIFIED INDUSTRIAL HYGIENIST.

IF WE DO NOT INSPECT THIS EQUIPMENT DURING THIS 90 DAY PERIOD, THIS TEMPORARY CERTIFICATE WILL BE EXTENDED. YOU NEED NOT APPLY FOR SUCH AN EXTENSION.

QUESTIONS ABOUT THIS DOCUMENT SHOULD BE DIRECTED TO THE PERMITS AND CERTIFICATES SECTION AT 609-292-6716 OR THE ADDRESS BELOW.

NOTE: This document must be readily available for inspection at the source location.

Approved by: William F. Hart,
Supervisor
Permits & Certificates Section

N.J. Department of Environmental Protection
Bureau of Air Pollution Control
CN-027
Trenton, New Jersey 08625

7/8/82 DEB

Attachment B
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F2004 # → 81-1

5/19/81

HAZARDOUS WASTE FACILITY

REGISTRATION: SLUDGE

ROASTING SYSTEM

LCP CHEMICALS, NEW JERSEY, INC.

100682

Attachment C

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7:26 - 8.5 Environmental and Health Impact Statement

A. Executive Summary

LCP Chemicals - New Jersey, Inc. is a wholly owned subsidiary of Linden Chemicals and Plastics, Inc. The plant site is located in a heavy industrial area in Linden, New Jersey. Products manufactured at the plant are chlorine, caustic soda, hydrogen, muriatic acid, anhydrous hydrogen chloride, and bleach. The major raw materials used are rock salt (NaCl), electrical power, and water. Mercury is used in the chlorine cells in the manufacture of chlorine.

Mercury contaminated sludges are generated daily during the preparation and purification of brine solutions made from mixing rock salt and water. Mercury contaminated sludges are also generated in the wastewater treatment process. The daily quantities of sludge generated is directly related to chlorine production.

At the present time environmentally acceptable landfill sites for the burial of hazardous wastes are limited to Niagara Falls, New York and Pinewood, South Carolina for the east coast region. These sites contain limited capacity for the large volumes of hazardous waste generated daily by the heavily industrialized eastern section of the United States. Since hazardous wastes can remain hazardous for an extended period of time and the average landfill life is thirty years, landfilling of hazardous waste is only a temporary solution.

In order to internally eliminate hazardous waste accumulation and landfilling LCP Chemicals - New Jersey, Inc. has developed a proprietary process called the Sludge Roasting System. The purpose of this system is to detoxify our mercury bearing hazardous waste generated in the plant and produce a final product suitable for off site shipment to a sanitary landfill. Additional benefits are the recycling and recovery of mercury for plant use.

7:26 - 8.5 Environmental and Health Impact Statement

B. Proposed Facility

(i) Owner
(ii) Operation
See section 7:26 - 8.6 Disclosure Statement

C. Purpose and Need for Facility

(i) Objectives - See paragraph 4 of (A) Executive Summary
(ii) Types of Hazardous Wastes Handled:
Only hazardous waste generated at LCP Chemicals will be handled. They are:

1. EPA Hazardous Waste Number K071
Brine purification muds generated from the mercury cell process in chlorine production, where separately purified brine is not used.

2. EPA Hazardous Waste Number K106
Wastewater treatment sludge from the mercury cell process in chlorine production.

3. Proposed Site

(i) Site location and description - See Section 7:26 - 8.7, Specific Site Information

(ii) History of Site Use:

The site of the Sludge Roasting System is an unused parcel of land owned by LCP Chemicals since 1972. Prior to 1972 the site was owned by GAF Corporation. A concrete pad with drainage channels was poured in 1978 for the Sludge Roaster pilot plant. The pad was expanded to accomodate the present full scale Sludge Roasting System.

4. (i) Facility Operation - See Section 7:26 - 8.9
(ii) Engineering Design - See Section 7:26 - 8.10

5. Project Schedule

The Sludge Roasting System equipment has been installed. Minor modifications and trial runs are presently being conducted. A technical evaluation of the system by the New Jersey Solid Waste Administration and approval to dispose of the final product in an offsite sanitary landfill is required before continuous operation can begin.

HEAVY METAL

Analysis of roasted sludge and leachate from the roasted sludge referenced by RCRA leachate specifications

Leachate & Analysis

	RCRA Spec.	Roasted Product (3 samples)		
	Mg/1	Mg/1 3/30/80	Mg/1 5/20/81	Mg/1 10/19/80
As	5.0	.027	(.01	(.001
Ba	100.0	1.54	(.05	3.72
Cd	1.0	.06	(.01	.016
Cr	5.0	.068	(.02	
Pb	5.0	.065	(.02	.40
Hg	.2	.003	(.033	(.0005
Se	1.0	(.001	(.01 (ND)	.0005
Ag	5.0	(.04	(.02	.03
Cu			(.02	

Roasted Product Analysis

	10/19/80 PPM	5/20/81 PPM
As	4.35	(.3
Ba	819.9	1360
Cd	10.83	5.5
Pb	85.16	123
Hg	16.04	8.4
Se	(.1	(2.0
Ag	3.68	(2
Be	(2,0	
Ni	44.9	
Cu		390
Cr		58

Mem. ... 7-5289 ... Chemical
ADM-012
BC - HC

MEMO

NEW JERSEY STATE DEPARTMENT OF ENVIRONMENTAL PROTECTION

TO Ralph Pasceri, Chief, Hazardous Waste

FROM John Elston, Chief, Air Quality Management DATE July 28, 1981

SUBJECT LCP Chemical New Jersey Inc., Linden, Union County, Application 81-13

The Hazardous Waste Facility Registration Application for a mercury sludge roasting system was received on May 28, 1981. The application was reviewed by the Bureau of Major Project Review, the New Source Review Section, and the Bureau of Air Quality Management and Surveillance.

The sludge roasting system has already been granted a temporary Certificate to Operate, No. 44133. Controlled mercury emissions from the facility are listed as 0.11 tons/yr. EPA's PSD significant emission rate for mercury is 0.1 ton/yr. Therefore, the sludge roasting system can be considered a significant emission source of mercury.

Some doubt exists concerning the effectiveness of scrubbers in controlling mercury emissions. Because of this uncertainty, the Bureau of Major Project Review has recommended to the Bureau of Air Pollution Control Operations that a stack test for mercury be performed as part of the field evaluation of the sludge roasting system.

Atmospheric dispersion modeling analysis of the mercury sludge roasting system (attached) shows that ambient mercury concentrations beyond the applicant's property line may be as high as 0.2 ug/m^3 (annual average) with the given emission rate. This concentration is in great excess of the Estimated Permissible Concentration (EPC) for mercury(1) which is .024 ug/m^3 (annual average). Receptor locations used in the model are shown in Figure 1. The area where calculated concentrations exceed .05 ug/m^3 is outlined in Figure 2.

Therefore, assuming the stack test shows that emissions are equal or above the rates indicated the permit, applicants should be required to either reduce emissions, raise the stack height and/or increase the exit velocity so that ambient concentrations will be within the defined limits.

John Elston

JE:AB:drf
Attachment

4-5289

100686

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Attachment D

cc: Bob Yeates — 43013
Chuck Steiner
Ernest Mancini

(1) EPC (ug/m3) = 1000 x TLV x 40/168 x 1/100, where TLV is the threshold limit value for mercury (.01 mg/m^3), 40/168 is a correction factor for length of exposure; (i.e. 168 hours per week instead of 40 hrs/wk) and 1/100 is a safety factor to account for the differences between industrial workers and potential high sensivity of certain sectors of the general population (TLV defined in GCA, 1980, State of New Jersey Incinerator Study, Volume II: Technical Review and Regulatory Analysis of Sewage Sludge Incineration. Final Draft Report.)

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100687

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VHMCDMQC 07/21/81

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR POLLUTION CONTROL
C L I M A T O L O G I C A L D I S P E R S I O N M O D E L

LCP MERCURY SLUDGE ROASTING SYSTEM

RUN 1

Prop. Line = .015 Km

CALIBRATED CONCENTRATION (MICROGRAMS/CU. METER)

POLLUTANT: HG

RECEPTOR NO.	ID	X COORD	Y COORD	POINT SOURCES	AREA SOURCES	BACKGROUND	TOTAL	POINT SOURCES
1	— .025 Km	566.87	4495.30	0.2	0.0	0.0	0.2	
2		566.87	4495.29	0.2	0.0	0.0	0.2	
3		566.86	4495.28	0.1	0.0	0.0	0.1	
4		566.85	4495.27	0.1	0.0	0.0	0.1	
5		566.84	4495.28	0.2	0.0	0.0	0.2	
6		566.83	4495.29	0.1	0.0	0.0	0.1	
7		566.82	4495.30	0.1	0.0	0.0	0.1	
8		566.83	4495.31	0.1	0.0	0.0	0.1	
9		566.84	4495.32	0.1	0.0	0.0	0.1	
10		565.85	4495.32	0.1	0.0	0.0	0.1	
11	— .033 Km	566.87	4495.33	0.2	0.0	0.0	0.2	
12		566.88	4495.32	0.2	0.0	0.0	0.2	
13		566.88	4495.30	0.2	0.0	0.0	0.2	
14		565.88	4495.28	0.1	0.0	0.0	0.1	
15		566.87	4495.27	0.1	0.0	0.0	0.1	
16		566.85	4495.27	0.1	0.0	0.0	0.1	
17		566.83	4495.27	0.1	0.0	0.0	0.1	
18		565.82	4495.29	0.1	0.0	0.0	0.1	
19		566.82	4495.30	0.1	0.0	0.0	0.1	
20		566.82	4495.32	0.1	0.0	0.0	0.1	
21		566.83	4495.33	0.1	0.0	0.0	0.1	
22		566.85	4495.33	0.1	0.0	0.0	0.1	
23	— .042 Km	566.87	4495.34	0.1	0.0	0.0	0.1	
24		566.89	4495.32	0.1	0.0	0.0	0.1	
25		566.89	4495.30	0.1	0.0	0.0	0.1	
26		566.89	4495.28	0.1	0.0	0.0	0.1	
27		566.87	4495.27	0.1	0.0	0.0	0.1	
28		566.85	4495.26	0.1	0.0	0.0	0.1	
29		566.83	4495.27	0.1	0.0	0.0	0.1	
30		565.81	4495.28	0.1	0.0	0.0	0.1	
31		566.81	4495.30	0.1	0.0	0.0	0.1	
32		566.81	4495.32	0.1	0.0	0.0	0.1	
33		566.83	4495.34	0.1	0.0	0.0	0.1	
34		566.65	4495.34	0.1	0.0	0.0	0.1	
35	— .077 Km	566.89	4495.37	0.1	0.0	0.0	0.1	
36		566.92	4495.34	0.1	0.0	0.0	0.1	
37		566.93	4495.30	0.1	0.0	0.0	0.1	

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VHMCDMQC 07/21/81

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR POLLUTION CONTROL
C L I M A T O L O G I C A L D I S P E R S I O N M O D E L

LCP MERCURY SLUDGE ROASTING SYSTEM

RUN 1

CALIBRATED CONCENTRATION (MICROGRAMS/CU. METER)

POLLUTANT: HG

RECEPTOR NO.	ID	X COORD	Y COORD	POINT SOURCES	AREA SOURCES	BACKGROUND	TOTAL	POINT SOURCES
38		565.92	4495.26	0.1	0.0	0.0	0.1	
39		566.89	4495.23	0.0	0.0	0.0	0.0	
40		566.85	4495.22	0.0	0.0	0.0	0.0	
41		566.81	4495.23	0.1	0.0	0.0	0.1	
42		566.78	4495.26	0.0	0.0	0.0	0.0	
43		566.77	4495.30	0.0	0.0	0.0	0.0	
44		566.78	4495.34	0.0	0.0	0.0	0.0	
45		566.81	4495.37	0.0	0.0	0.0	0.0	
46		566.85	4495.34	0.1	0.0	0.0	0.1	
47	.1(3)km	566.93	4495.44	0.0	0.0	0.0	0.0	
48		566.99	4495.38	0.0	0.0	0.0	0.0	
49		567.01	4495.30	0.0	0.0	0.0	0.0	
50		566.99	4495.22	0.0	0.0	0.0	0.0	
51		566.93	4495.16	0.0	0.0	0.0	0.0	
52		566.85	4495.14	0.0	0.0	0.0	0.0	
53		566.77	4495.16	0.0	0.0	0.0	0.0	
54		566.71	4495.22	0.0	0.0	0.0	0.0	
55		566.69	4495.30	0.0	0.0	0.0	0.0	
56		566.71	4495.38	0.0	0.0	0.0	0.0	
57		566.77	4495.44	0.0	0.0	0.0	0.0	
58		566.85	4495.46	0.0	0.0	0.0	0.0	
59	1 Km	567.35	4496.16	0.0	0.0	0.0	0.0	
60		567.72	4495.80	0.0	0.0	0.0	0.0	
61		567.85	4495.30	0.0	0.0	0.0	0.0	
62		567.72	4494.80	0.0	0.0	0.0	0.0	
63		567.35	4494.43	0.0	0.0	0.0	0.0	
64		566.85	4494.30	0.0	0.0	0.0	0.0	
65		566.35	4494.43	0.0	0.0	0.0	0.0	
66		565.90	4494.80	0.0	0.0	0.0	0.0	
67		565.85	4495.30	0.0	0.0	0.0	0.0	
68		565.98	4495.80	0.0	0.0	0.0	0.0	
69		566.35	4496.16	0.0	0.0	0.0	0.0	
70		566.85	4496.30	0.0	0.0	0.0	0.0	

100689

91-E34

FIGURE 1

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

RECEPTOR LOCATION *

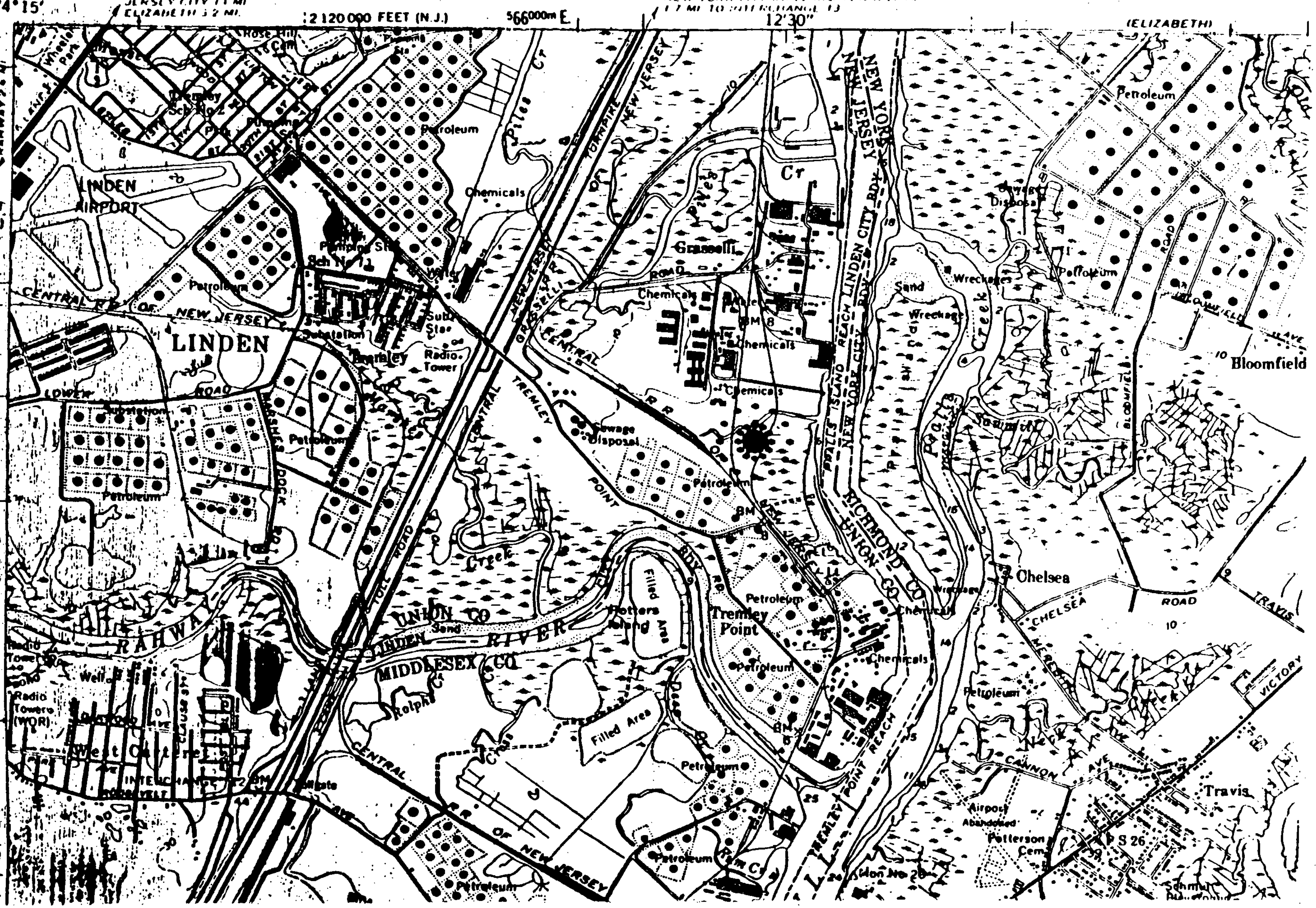

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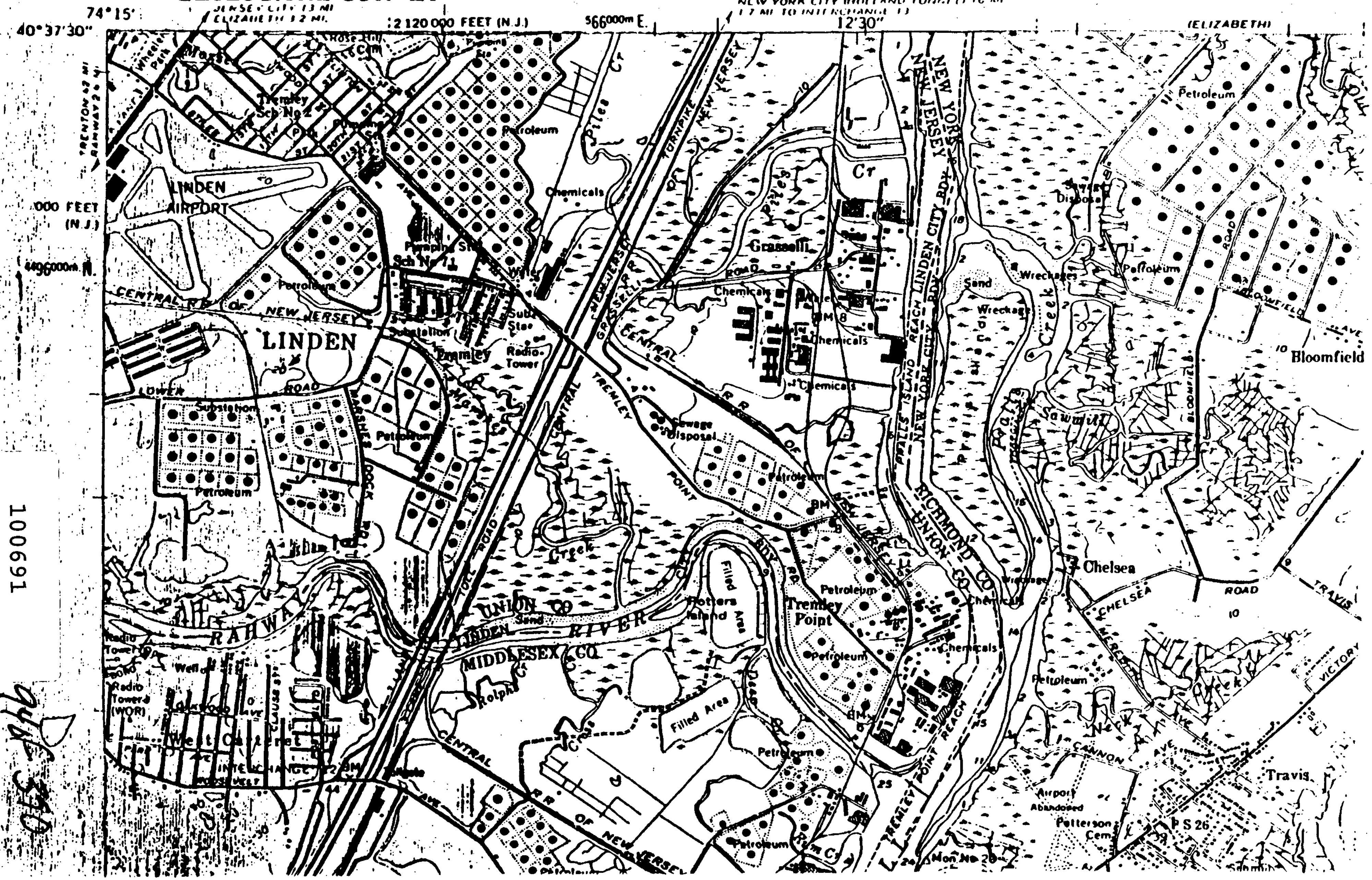
FIGURE 2

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Area Where Concentrations Exceed .05 ug/m3 Outlined in Red



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ADM-012

MEMO

NEW JERSEY STATE DEPARTMENT OF ENVIRONMENTAL PROTECTION

TO Angel Chang, Bureau of Hazardous Waste

FROM Raymond Dyba, Bureau of Air Quality Management & Surveillance

DATE November 6, 198

SUBJECT LCP Waste Pile Analysis

The Air Sampling Report for LCP Chemicals was received October 14, 1981.

Ambient concentrations of mercury resulting from waste pile emissions will be within the assimilative capacity of the air environment, assuming the given emission rate of 133 g/day. Calculations indicate that a 24-hour average of 6.64 ($\pm$1.5) x 10^{-2} ug/m^3 (1) will result from fugitive emissions attributable to the waste pile. This concentration is below the de minimis value for a 24-hour average ambient mercury concentration, 0.25 ug/m^3 (2).

Raymond Dyba

Raymond Dyba

(1) u=6, stability class = D, initial dispersion 21.27 meters assumed (calculations attached).

(2) Federal Register, Vol. 45, No. 154, Thursday, August 7, 1980, pg. 52709.

RD:AB:raf
Attachments

D 95of390

100692

19391

LEGAL

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL QUALITY
JOHN FITCH PLAZA, P. O. BOX 2807, TRENTON, N. J. 08625

ORDER

To: LCP Chemicals - New Jersey, Inc.
Peter Tracey, Registered Agent
Raritan Plaza II
Edison, New Jersey 08837

Re: N.J.A.C. 7:27-8.3(e)2
Plant Identification No. 40327
Violation Occurred on Premises
Known As:
Foot of South Wood Avenue, Lot 3, Block 587, Linden City, Union County, New Jersey

WHEREAS, the State Department of Environmental Protection has determined by investigation(s) or inspection(s) made pursuant to the Provisions of the New Jersey Air Pollution Control Act that on November 5, 1981 you did violate Title 7, Chapter 27, Subchapter 8, Section 8.3(e)2, of the New Jersey Administrative Code.

The investigation(s) discloses the use of roaster with a ruptured muffler plate allowing Mercury emissions to bent directly through roaster burner exhaust to atmosphere and having installed and operated four propane burners not included on permit, therefore not functioning properly in accordance with Permit (P-44133) and Certificate (CT-44133).

NOW, THEREFORE, YOU ARE HEREBY ORDERED, to cease violation of said Subchapter on the premises owned, leased, operated or maintained by you on or before May 19, 1982.

Dated: May 4, 1982

Edward J. Londres, Assistant Director
Enforcement Branch

cc: Local District Field Office Central Jersey Health Comm.
Metro

CERTIFIED MAIL

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Attachment E

100693

VAP001
Jul. 76

LCP CHEMICALS-N.J., INC.

A Subsidiary of Linden Chemicals & Plastics, Inc. • P.O. Box 484 • Linden, NJ 07036 • (201) 862-1666

cc: Frank Coolick
Tom Pluta

- Alan Bookman
4-5289

September 21, 1981

Mr. Keith A. Onsdorff
State of New Jersey
Dept. of Environmental Protection
Regulatory & Governmental Affairs
P.O. Box 1390
Trenton, New Jersey 08625

Dear Mr. Onsdorff:

Attached, per the recently signed Consent Order, please find data and results reflecting ambient air analysis for Hg in the area of our solid waste pile, as performed by Recon Systems, Inc., of Somerville, N.J.

Should it be of any value, Federal EPA requirements for escaping Hg from a chlorine manufacturing facility is 2300 Ms/day.

If there are any questions regarding the attached, please advise.

Sincerely,

W.J. Fledderman

W.J. Fledderman,
PLANT MANAGER

WJF/ph

att.

100694

Attachment F

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RECON SYSTEMS, INC.

51 FIFTH STREET, P.O. BOX 842

Somerville, New Jersey 08876

201-685-0440

AIR SAMPLING REPORT

For

LCP CHEMICALS
P. O. Box 484
Linden, NJ 07036

Source Tested:

LCP Chemicals
Waste Pile

In Fulfillment of
Purchase Order No. 22684

RECON Project No. 1540

June 15, 1981

SYSTEMS

RESOURCE & ENVIRONMENT CONSERVATION

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F

100695

RI ∟ON SYSTEMS, INC
61 Fifth Street, P.O. Box 842
Somerville, N. J. 08876
201-685-0440

Air Sampling Report for LCP Chemicals On Waste Sludge Pile

INTRODUCTION

The air in the vicinity of the waste sludge pile was sampled for mercury on June 4, 1981. This report contains the following information.

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F

SUMMARY AND RESULTS

Real time mercury in air measurements were taken three feet above the surface of the waste pile.

Figure 1 summarizes these measurements which showed a range of concentrations of 0.001-0.005 mg/m^3 with 0.003 mg/m^3 being a prevalent or typical value. (3000 ng/M^3)

In addition, several 20-30 minute air samples were taken six inches above the surface. These were analyzed immediately afterward and showed (Figure 2) a range of 0.003-0.0126 mg/m^3, with an average of 0.0064 mg/m^3. (6400 ng/M^3)

An attempt at estimating the emissions from the pile during testing was made by utilizing the cross wind speed, the pile dimensions and the mercury concentrations. This resulted in an estimate of 113 grams/day.

Obviously the emissions are a function of many variables including ambient temperature, wind speed, wind persistence, solar conditions, pile temperature and probably others. Therefore the above estimate must be treated as an estimate for that day only.

This report is submitted by:

Richard F. Toro

Richard F. Toro, Vice President

June 15, 1981

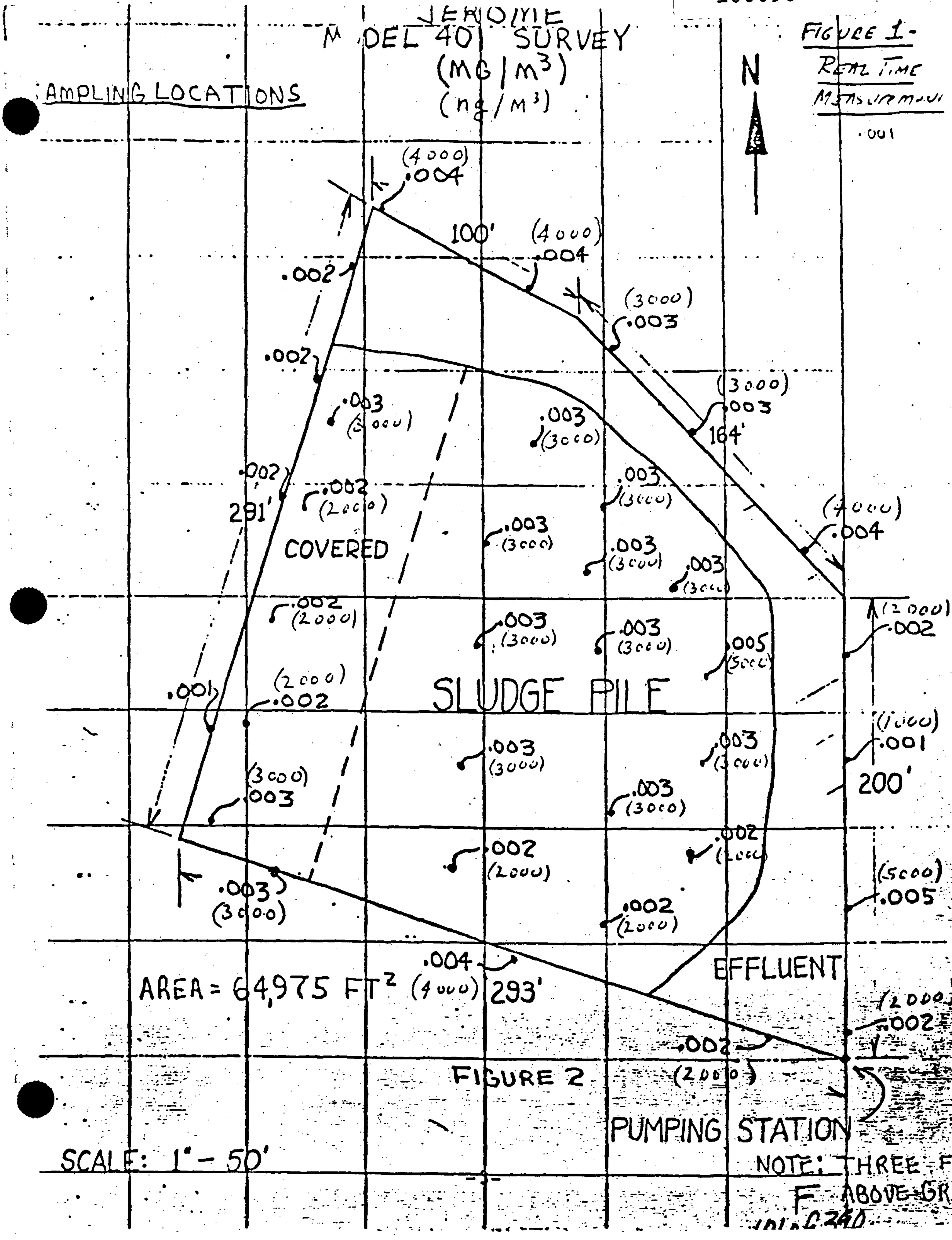
Frank W. Swetits

Per Frank W. Swetits
Senior Engineer

I am in responsible charge of RECON's stack test work, and have discussed and reviewed the procedures and results of this set of tests with the relevant field and laboratory personnel.

Norman J. Weinstein, P.E.
New Jersey License 19536

100698



JEROME
MODEL 401 SURVEY
(MG/M3)
(ng/M3)
SAMPLING LOCATIONS
FIGURE 1 -
REAL TIME
MEASUREMENT
.001
N
(4000) .004
100'
(4000) .004
(3000) .003
(3000) .003
164'
(4000) .004
.002
.002
.003 (3000)
.003 (3000)
.002
.002 (2000)
291'
COVERED
.003 (3000)
.003 (3000)
.003 (3000)
.003 (3000)
.002 (2000)
.003 (3000)
.003 (3000)
.005 (5000)
(2000) .002
SLUDGE PILE
.001
(2000) .002
(1000) .001
.003 (3000)
.003 (3000)
200'
(3000) .003
.003 (3000)
.002 (2000)
.002 (2000)
(5000) .005
.003 (3000)
.002 (2000)
.004 (4000)
AREA = 64,975 FT2
293'
EFFLUENT
(2000) .002
.002 (2000)
FIGURE 2
PUMPING STATION
SCALE: 1" - 50'
NOTE: THREE F
ABOVE GR

100699

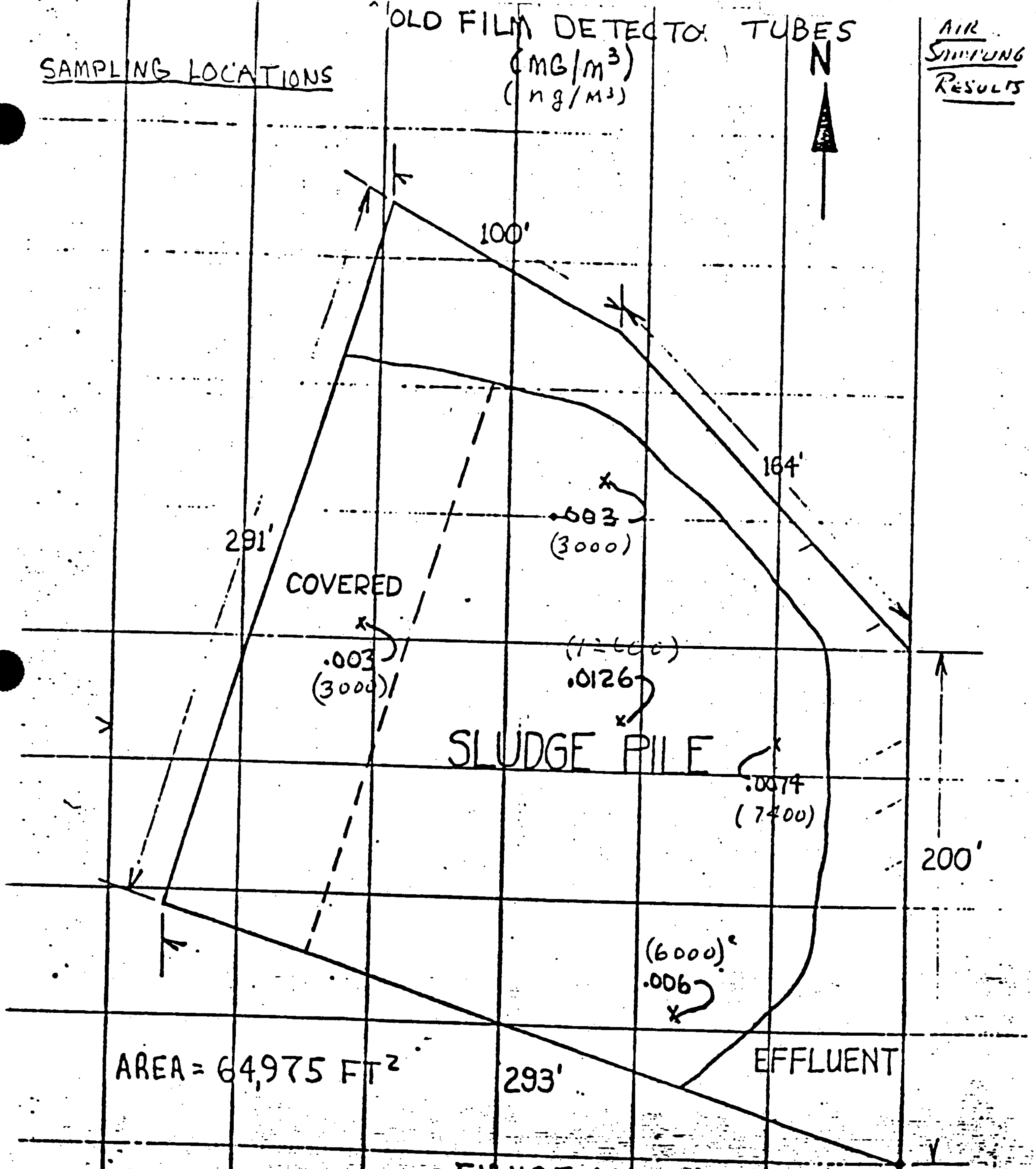


FIGURE 1

SCALE: 1" – 50'

NOTE: SIX INCH FROM GRY

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AMBIENT CONDITIONS

During the testing, the following parameters were also measured:

wind speed: 525 ft/minute (~6 mph)
wind direction: from the west
pile temperature: 74°F
air temperature: 81°F
barometric: 29.98 "Hg

CALCULATION OF EMISSIONS FROM PILE

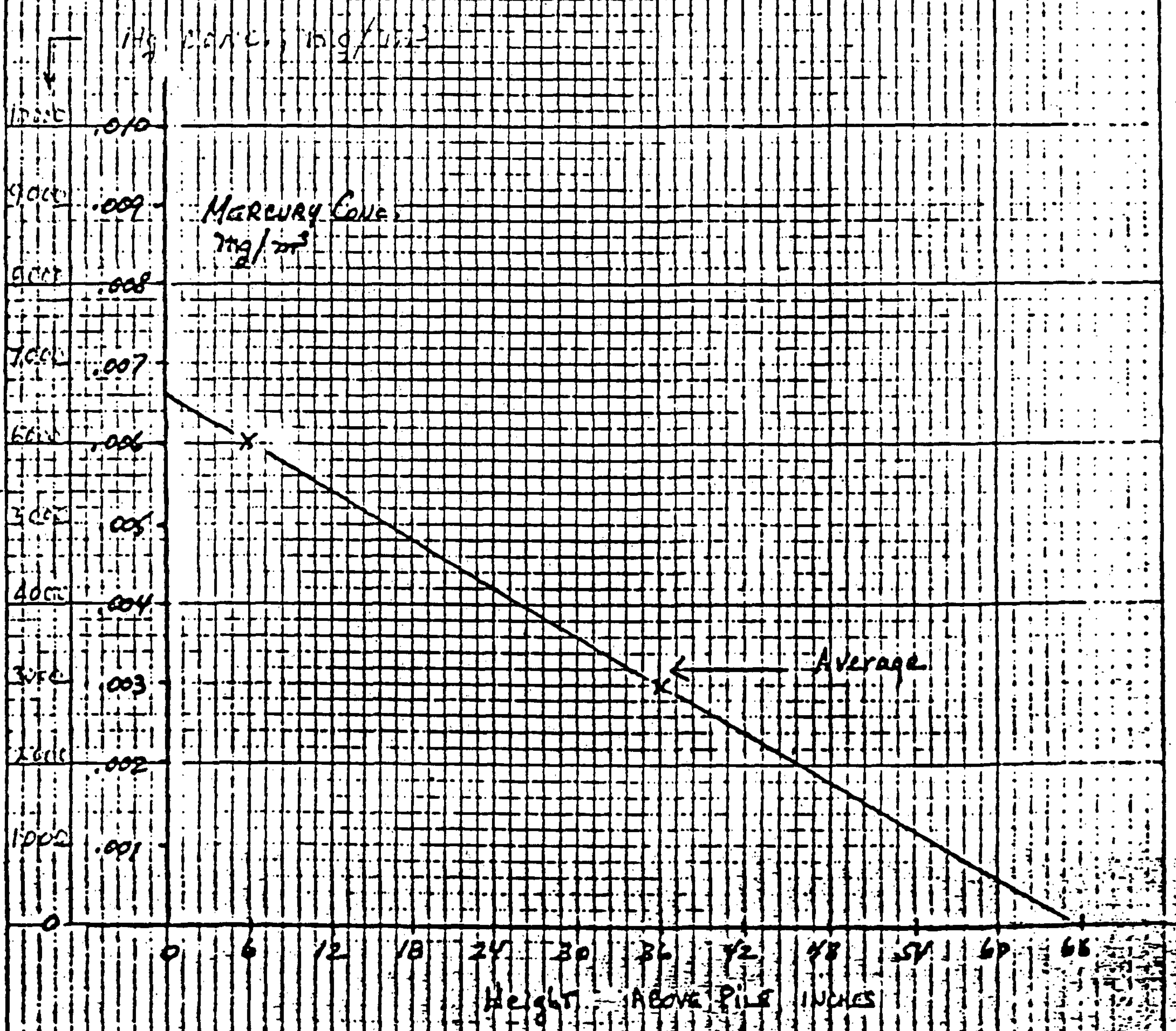
From Figure 3, one can estimate, assuming the concentration profile is linear, the approximate significant elevation and average mercury concentration in that air space. According to that estimate, an average of 0.0032 mg/m^3 concentration over an air space of 5.5 feet can be assumed.

Utilizing the wind speed of 525 ft/min and the maximum width (300 feet) of the pile perpendicular to the wind from the west, the total emissions can be estimated:

$$\text{24 hour emission rate} = \frac{525\ \text{ft}}{\text{min}} \times 5.5\ \text{ft} \times 300\ \text{ft} \times \frac{(.305)^3\,\text{m}^3}{\text{ft}^3} \times \frac{.0032\ \text{mg}}{\text{m}^3} \times \frac{\text{gm}}{1000\ \text{mg}} \times \frac{1440\ \text{min}}{\text{day}}$$

= 113 grams/24 hours

FIGURE 3
ESTIMATED VERTICAL
CONCENTRATION PROFILE



PROCEDURES

The Jerome Instruments Model 401 Gold Film Mercury Vapor analyzer was used as a real time instrument. The waste pile was surveyed at 35 locations shown on Figure 1. The 401 was maintained approximately three feet above the waste pile. The results of the survey are shown on Figure 1.

In addition, the Jerome Model 301 was used in conjunction with Gold Film Mercury detector tubes. Air sampling pumps were calibrated to maintain required flow rates. The sampling pumps were connected to the Gold Film tubes, and placed at the locations shown on Figure 2. After sampling was completed the tubes were desorbed to volatilize the absorbed mercury back into the flow system of the 301; and mercury concentrations were obtained.

Only elemental mercury is detected by these procedures.

CHEMICALS-N.J., INC.
A Subsidiary of Linden Chemicals & Plastics, Inc. • P.O. Box 484 • Linden, NJ 07036 • (201) 862-1666

September 1, 1981

Mr. Angel Chang
Department of Environmental Protection
State of New Jersey
32 E. Hanover Street
Trenton, NJ 08625

Dear Mr. Chang:

Enclosed is a copy the drawing "Sludge Roaster Site Plan". This drawing shows the concrete pad area that our sludge roaster and accessories are erected on. The drawing is marked in red to show where we plan to install an eight inch high block wall. This, I believe, will be in compliance with your verbal request. This enclosure is capable of holding more than 12,000 gallons in the event of a spill. This is more than twice the contents of all the tanks contained in the area. In addition, the wall will prevent anything from being washed off of the pad onto the ground.

I trust that this installation will satisfy your requirements and will protect the environment and ground water in the area. Should there be any questions, please feel free to contact me.

Sincerely,

John D. Downes

John D. Downes
Technical Superintendent

JDD:rb
Enclosure

100703

Attachment G
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Steve Corvino

Mr. Burkett + Champi will be at L+I Bldg @ TUE. June 17th to answer any questions we may have concerning this proposal for disposal. Harvey has set aside the date for you if you are interested.

LINDEN CHLORINE PRODUCTS, INC.

PRELIMINARY REPORT ON BRINE SLUDGE

Presented To:

New Jersey Department Of
Environmental Protection
Bureau of Solid-Waste Management

June 9, 1975

Prepared By:

R. J. Burkett, Technical Superintendent

100704

Attachment H
1070 390

I. INTRODUCTION

Linden Chlorine Products, Inc. is developing a program for brine sludge disposal. The contamination of the sludge with mercury dictates that such disposal be accomplished. Although it is standard practice in the chloroalkali industry to impound brine sludges in earthen basins[1], we recognize that this is environmentally unsound and unacceptable. It is the policy of LCP to accomplish this disposal as quickly as possible with the advise and consent of the Bureau of Solid-Waste Management.

This report was prepared to provide the Bureau with details concerning LCP and our brine sludge problem. It includes the results of the investigation conducted since our first meeting on March 18, 1975.

II. COMPANY HISTORY

LCP was formed in 1972 for the sole purpose of starting up and operating the divested GAF Corporation Chlorine/Caustic manufacturing plant in Linden, New Jersey. The plant is located next to the GAF complex and was operated by GAF for a total of ten years before shutdown in 1971. LCP has no other facilities and produces only three products: chlorine, sodium hydroxide, and hydrogen.

The plant employs 175 people.

III. PROCESS

The plant utilizes mercury cell technology. Many technological innovations were introduced when LCP took over operation. A major change was the conversion from graphite to DSA anodes.

A process flowsheet of the brine saturation area is included. It is a closed loop process with the addition of rock salt and the removal of impurities, i.e. sludge. The mercury contamination occurs in the cells. The circulating brine dissolves and entrains a small amount of mercury of which a portion (100-500 ppm) is purged with the sludge.

The sludge is pumped to the brine sludge pond where the solids settle out. The water is recycled to the sludge receiver and brine filters

IV. CHEMISTRY

Rock Salt: Contains 1 to 1½% inerts $CaSO_4$, $MgCl_2$, Metals, Dirt

$$CaSO_4 + Na_2CO_3 \longrightarrow CaCO_3 \downarrow + Na_2SO_4$$
$$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4 \downarrow + 2NaCl$$

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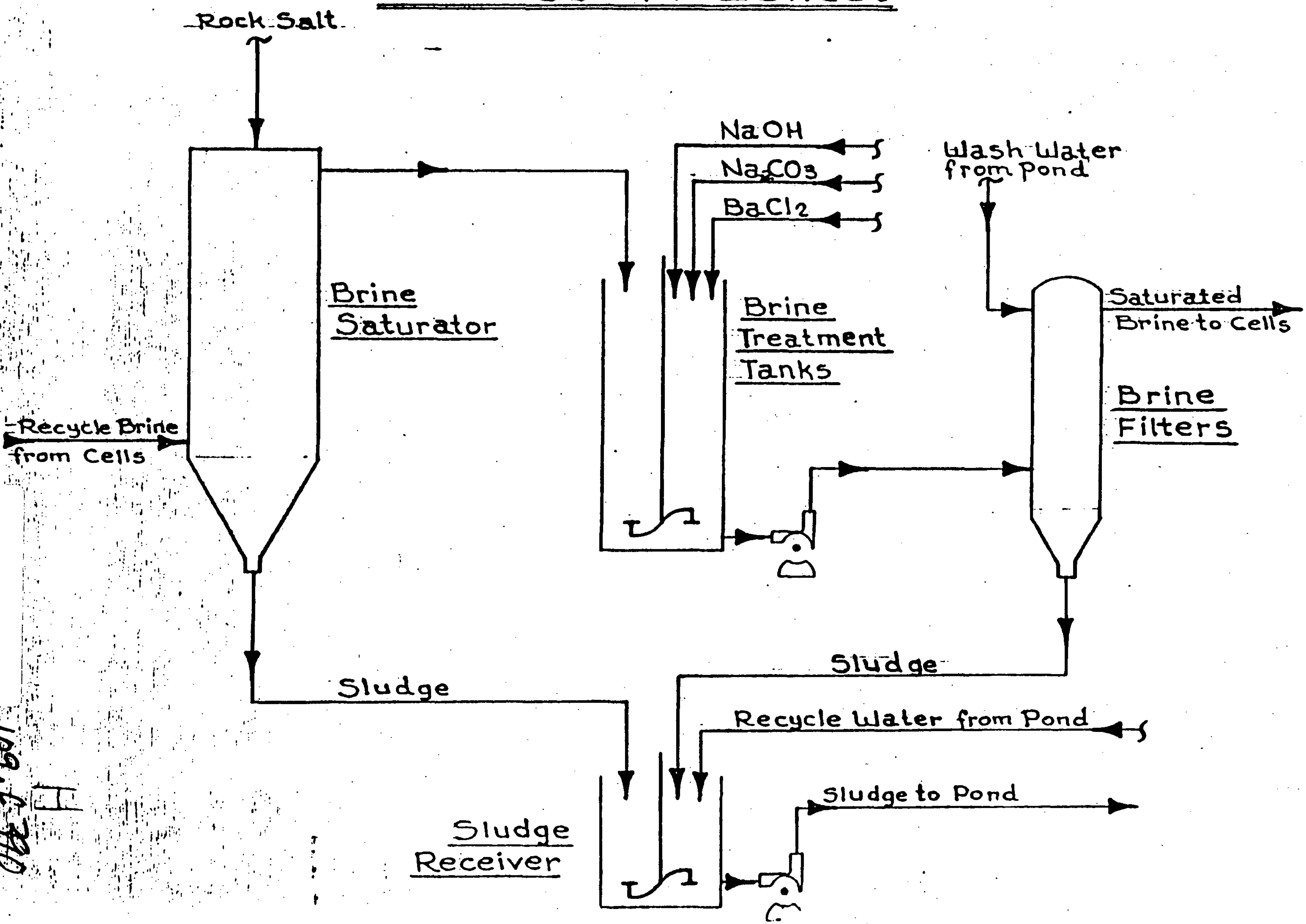
Process Flowsheet



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IV. CHEMISTRY (continued)

$MgCl_2 + 2NaOH \longrightarrow Mg(OH)_2 \downarrow + 2NaCl$

Metals + NaOH $\longrightarrow$ Fe, Cr, V, Hydroxides

Sludge Composition:

NaCl	15 - 20%
$BaSO_4$	40 - 50%
$CaCO_3$	10 - 15%
$CaSO_4$	10 - 15%
Metal Hydroxides	2%
Dirt	2%
Hg	100 - 500 ppm

Material Balance

Theoretical: $1.65 \frac{T\ NaCl}{T\ Cl_2}$

Actual: $2.0 \frac{T\ NaCl}{T\ Cl_2}$

Sludge Production:

$$2.0 \left.\frac{T\ NaCl}{T\ Cl_2}\right| \left.\frac{.015\ LB\ Inerts}{LB\ \ NaCl}\right| \frac{250\ T\ Cl_2}{Day} = 7.5 \frac{T\ Sludge}{Day}$$ (750 gall

Estimated Sludge Inventory: 300,000 ft^3

V. SLUDGE DISPOSAL

During the operation of a chlorine cell using graphite anodes, the graphite is consumed. The graphite dissappears as CO_2 gas and is eroded in fine particles. The small particles are picked up by the brine and eventually find their way into the brine sludge.

LCP has two sludges. The first is the contents of the existing pond which represents ten years of operation and contains significant amounts of graphite. The second is current and future sludges which contain no graphite. Due to the different mercury extraction characteristics of the sludge from the DSA process[2], LCP is proposing two sludge disposal processes. Each is discussed below.

Existing Sludge Pond

On March 18, 1975 I met with Mr. Saltzman and Mr. Hui, NJDEP, concerning LCP's brine sludge pond. The purpose of the meeting was to discuss the compliance status of LCP and the various disposal processes acceptable to the NJDEP.

V. <u>SLUDGE DISPOSAL</u> (continued)

<u>Existing Sludge Pond</u>

We discussed the history of the plant, the process and the factors causing the sludge generation. We explored various disposal techniques currently available. At the conclusion of the meeting I was given a list of "waste processing facilities" and asked to contact the appropriate vendors. I was to report back on my findings. These are the results of my investigations:

March 19:	I contacted by telephone the following companies: 1. Chem-Trol - Model City, New York 2. Chemfix - Pittsburgh, Pennsylvania 3. Frontier Chemical - Niagara Falls, New York 4. Rollins Environmental - Bridgeport, New Jersey 5. Browning Ferris Ind. - Pedricktown, New Jersey
March 24 to April 2:	All five companies visited the plant and took samples.
April 17 to May 19:	Received bids from Chem-Trol and Chemfix.
May 19 to Present:	Contacted other companies but as yet no response.

Both Chem-Trol and Chemfix bid on the same basis which was disposal of the entire contents of the sludge pond.

<u>Company</u>	<u>Method</u>	<u>Cost</u>
Chem-Trol	Hauling to secured landfill	$1,038,400
Chemfix	Fixation of heavy metals and landfill	$ 110,000

The Chem-Trol proposal requires no further statement as to environmental impact. It is a recognized waste treatment company of the highest quality. It's secured landfill operation stands on it's record. However, fully one-half of the costs in their proposal is accounted for by freight charges. This is a financial burden which LCP cannot bear. Their proposal is unacceptable.

The Chemfix process offers a solution which could be economically absorbed by LCP. However, the question of leachate remains. Chemfix has run a sample of our sludge through their laboratories. The sample is now and will continue to be tested for mercury containination of the leachate.

V. SLUDGE DISPOSAL (continued)

Existing Sludge Pond

LCP is prepared to accept the Chemfix proposal. However, both we and Chemfix feel it prudent to run a preliminary test to verify the laboratory findings.

The test could be conducted this summer with a follow-up report on the leachate results. Total pond treatment could then be accomplished with the consent and approval of NJDEP.

Current Sludge Production

As of April, 1975 LCP had converted completely to Dimensionally Stable Anodes (DSA) from graphite anodes. (A DSA is a titanium metal anode which is thinly coated with platinum metal.) A recently published EPA report[2] and our own laboratory investigations show that in the absence of graphite, mercury can be successfully leached from brine sludges using sodium hypochlorite.

LCP feels that such a treatment process offers the opportunity to economically recover the brine sludge which we consider a valuable resource. Although all of the details have not been worked out, we are currently researching the process.

We propose to develop and install such an extraction process to treat current and future sludges. This would be a continuous process which would eliminate the accumulation of sludge.

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1. "Assessment of Industrial Hazardous Waste Pract
Chemical Industry", EPA Contract No. 68-01-2246
Versar, Inc., October 21, 1974

2. "Mercury Recovery from Contaminated Waste Wate
EPA Project 12040 HDU, Program 1BB037,
Richard Perry, Georgia-Pacific Corporation, Aug

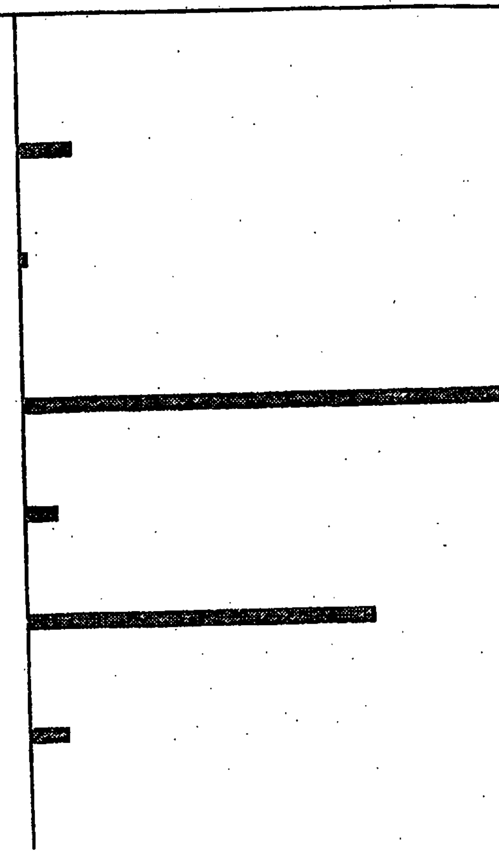
Exhibit I

GENERAL ANILINE & FILM CORPORATION

gaf

DISPOSITION OF GENERAL ANILINE'S INCOME IN 1955

Federal, State and Local Taxes	5.0%
Interest on Borrowed Capital	1.0%
Purchased Materials, Power, Rentals, Advertising, Transportation and General Overhead	50.2%
Depreciation on Buildings and Equipment	3.4%
Wages, Salaries and Employee Benefits	36.9%
Earnings for the year retained in the business	3.5%
	100.0%



To the Stockholders:

RESULTS OF OPERATIONS IN 1955 were considerably improved over those of 1954. Net income after taxes amounted to $4,217,000, $5.29 per Common A share, compared with $2,519,000, or $3.16 per share in 1954, and sales, the highest in the Company's history, totaled $121,248,000 against $104,964,000. In the Ozalid Division new high levels were reached in the production and sale of both copying machines and sensitized materials. Substantial increases in sales and profits were registered by the Dyestuff and Chemical Division which benefited from the revived textile market as well as from the growing demand for our detergents and special chemicals. The Ansco Division enjoyed record business and at the same time carried on a program of plant modernization designed to improve efficiency and reduce costs.

STOCKHOLDERS' EQUITY

Stockholders' equity totaled $106,396,000 at the end of 1955. In 1942, when the majority of the stock of the Company was vested by the U. S. Government, the comparable figure was $45,075,000.

DIVIDENDS

No dividends were paid in 1955. The directors considered the matter during the year and concluded that the interests of the Company were best served by retaining available funds to assure the expansion of the business and progress of the capital program.

FINANCE

Net working capital at the end of 1955 amounted to $79,403,000, a reduction of 7% since December 31, 1954, due to substantial additions to fixed assets. Total borrowing stands at $35,500,000, represented by an insurance company loan requiring pre-payments beginning June 1, 1956.

INVENTORIES

Company-wide inventories totaled $48,749,000 at the end of the year, compared with $47,374,000 at the end of 1954.

FOREIGN OPERATIONS

Exports in 1955 amounted to $10,737,000 and imports to $4,227,000, compared with $10,373,000 of exports and $2,910,000 of imports in 1954. Curtailed textile activity in Europe coupled with licensing restrictions and price competition had the effect of holding exports to a figure only slightly in excess of the 1954 total. However, Canadian sales in 1955 of both photographic and Ozalid products, as well as of dyestuffs and chemicals, were substantially higher than in the preceding year. Imports, which are showing rapid growth, consisted primarily of certain chemicals and of cameras made in Western Germany to Ansco's specifications.

PROPERTIES

The acetylene derivatives plant at Calvert City, Kentucky, mentioned in the 1954 Annual Report, was recently completed and placed in operation. This marks the first American commercial scale use of high pressure techniques for handling acetylene and the project represents a significant step toward diversification of the Company's products.

A 50-ton per day chlorine-caustic plant at Linden, New Jersey, was also completed recently. This plant fills a basic need for the Company's dyestuff production. Capacity at Linden, for producing surfactants (i.e., surface active agents) used mainly in detergents, was materially expanded and construction of a second surfactant plant at Calvert City was started toward the end of 1955. Growing demand for surfactants also resulted in the installation of bulk storage facilities in northern California.

At Ansco, a modern air-conditioned finished products warehouse was completed and occupied in April, 1955. In the Ozalid Division, construction of a combination paper converting and warehouse building was commenced in January, 1955 and is now about ready for occupancy. Surveys are currently being made on a proposed plant to house Ozalid machine manufacturing in the Johnson City area and on a new sensitized paper plant on the Pacific Coast.

Total additions during 1955 amounted to $12,834,000 and at the year end, the net book value of the Company's fixed assets was $58,508,000.

RESEARCH, DEVELOPMENT AND NEW PRODUCTS

Forty new products in the dyestuffs, pigments and surfactants fields were introduced during the year. Particular stress is being placed on development of a broader line of organic pigments to gain a greater share of the growing market in automobile finishes, inks, lacquers, enamels, and resins. With a view to long range development, increased emphasis was placed on research in such new fields as adhesives, agricultural chemicals and cosmetics.

The Ozalid Division introduced a completely new Streamliner machine and a re-designed model of the Printmaster; both of which found excellent customer acceptance. Development work on the fastest and largest diazo (Ozalid) type printing machine in the world was completed in 1955 and prototype models are being field tested. This model, the Printmaster 1000, as well as a 42 inch printer and developer designed to sell for less than $1,000, are scheduled for production late this year.

The Company's most talked about new product of 1955 was Anscochrome. Acclaimed by users throughout the country and in many magazine and newspaper articles, it is believed by competent critics to be unequalled. Its high quality quickly gained for it a large share of the color film market.

OWNERSHIP

No change in the control of the Company occurred during the year. However, the litigation between the Swiss claimant to the vested shares and the Government may be nearer to final disposition as a result of recent developments. On June 30, 1955, the United States Court of Appeals for the District of Columbia upheld a dismissal of Interhandel's suit for failure to comply with an order of the District Court for production of records, with the qualification that the dismissal will be vacated if Interhandel obeys the order within six months from termination of the appeal. On January 9, 1956, the United States Supreme Court refused to review this decision. If Interhandel produces the records by July 24, 1956, the litigation will continue. Failure to comply will terminate the main portion of the suit, leaving only the claims of non-enemy Interhandel stockholders.

Legislation intended to enable the Government to sell the vested shares despite the pendency of the litigation remains pending in the Congress. Officials of the Government have strongly recommended enactment of this legislation. A bill providing for the return of vested shares to former owners is also pending.

THE BUSINESS OUTLOOK

The prospects for 1956 are good. In the Ozalid Division a high continuing demand for all products is indicative of a volume increase over 1955. Increased acceptance of Anscochrome high speed color film and a generally improved product line are expected to gain for Ansco a greater share of the photographic market. A good level of activity in dyes and chemicals is forecast and substantial benefits are expected to be derived from the new chlorine-caustic and acetylene derivatives plants. End products based upon acetylene chemicals currently being marketed by customers of the Company include rubber plasticizers, dispersing agents for pigments and inks, detergent additives and special adhesives. The pharmaceutical industry in particular is finding increasing application for acetylene derivatives.

The Board of Directors, in January 1956, approved the construction of an ethylene oxide plant at Linden which will make available the basic material required in the manufacture of the Company's surfactants. This facility, scheduled to be in operation in 1957, is, like the chlorine-caustic plant, part of a capital program designed to give the Company an independence as to essential chemicals which it has long needed.

ORGANIZATION

John Hilldring was elected President of the Company in April 1955. Francis A. Gibbons was elected Senior Vice President at the same time. Leopold F. Eckler was elected Vice President and General Manager of the Ansco Division in June and Philip M. Dinkins was elected Vice President in charge of the Dyestuff and Chemical Division in May. Mr. Dinkins was formerly President of Jefferson Chemical Company and Dr. Eckler's appointment marked a resumption of service at Ansco which began in 1928, and continued until seven years ago when he joined the Celanese Corporation. Walter A. Hensel, Ozalid's General Manager, was elected a Vice President in December.

General Lucius D. Clay, distinguished soldier and industrialist; Dr. Robert R. Williams, renowned for the isolation and synthesis of Vitamin B_1, and Arthur E. Pettit, a member of the firm of Winthrop, Stimson, Putnam and Roberts, the Company's Counsel, were elected members of the Board of Directors during the year.

Dr. Fred Hoffman Rhodes, of Cornell University, who had served with distinction as a member of the Board for more than ten years found it necessary to curtail his activities and his resignation was regretfully accepted in June.

ACKNOWLEDGMENTS

The Board of Directors and Officers express their appreciation to the Company personnel for their fine work throughout the year and to Colonel Dallas S. Townsend, Director, Office of Alien Property, and members of his staff for their wise counsel and assistance.

By Order of the Board of Directors

John Hilldring

PRESIDENT

March 20th, 1956.

CONSOLIDATED EARNINGS

	Year Ended December 31, 1955	1954
NET SALES	$121,247,877	$104,964,134
INCOME ON SECURITIES — NET	295,297	560,688
Total	121,543,174	105,524,822
COSTS AND EXPENSES:		
Cost of products sold	81,430,486	70,974,777
Distribution and selling expenses	20,166,294	18,706,861
Research and development expenses	5,796,803	5,751,855
Administrative and general expenses	3,864,678	3,641,390
Interest on borrowed capital	1,157,250	1,207,250
Other deductions — net	192,700	213,688
Total	112,608,211	100,495,821
EARNINGS BEFORE FEDERAL TAXES ON INCOME	8,934,963	5,029,001
PROVISION FOR FEDERAL TAXES ON INCOME	4,718,000	2,510,000
NET EARNINGS FOR THE YEAR	$ 4,216,963	$ 2,519,001
PER SHARE OF COMMON A STOCK	$ 5.29	$ 3.16

NOTE: Provision for depreciation and amortization charged to costs and expenses amounted to $4,158,873 in 1955 and $3,984,126 in 1954.

Retained in the Business

	Year Ended December 31, 1955
Balance at beginning of year	$ 72,473,104
Add — Net earnings for the year	4,216,963
Balance at end of year	$ 76,690,067

Net Assets Employed in the Business

	December 31, 1955	1954
CURRENT ASSETS:		
Cash	$ 7,818,130	$ 10,090,854
U. S. Government and other securities, at the lower of cost or market	25,574,911	28,546,049
Receivables, less reserves	13,513,993	11,651,106
Inventories, at the lower of average cost or market	48,748,702	47,373,929
Total current assets	95,655,736	97,661,938
LESS — CURRENT LIABILITIES:		
Current installment on 2.95% note payable	1,000,000	—
Accounts payable	5,197,934	4,644,602
Taxes withheld at source	671,891	651,896
Accrued taxes, wages, etc.	2,813,859	3,560,181
Provision for Federal taxes on income	6,118,622	3,049,016
Reserve for workmen's compensation self-insurance, etc.	450,107	480,889
Total current liabilities	16,252,413	12,386,584
NET WORKING CAPITAL (Current assets less current liabilities)	79,403,323	85,275,354
PREPAID EXPENSES AND MISCELLANEOUS INVESTMENTS:		
Prepaid expenses and deferred charges	2,412,830	1,988,148
Marketable securities, at the lower of cost or market	457,310	558,259
Investment in common stock of I. G. Chemie	30,945	30,945
Other investments	83,052	83,052
	2,984,137	2,660,404
FIXED ASSETS, at cost:		
Land, buildings, machinery, equipment, etc.	96,759,410	84,957,770
Less — Reserves for depreciation	38,251,074	35,214,665
	58,508,336	49,743,105
PATENTS, TRADE-MARKS AND FORMULAS	1	1
NET ASSETS EMPLOYED IN THE BUSINESS	$140,895,797	$137,678,864

NANCIAL POSITION

Sources from Which Net Assets Were Provided

	December 31, 1955	1954
BORROWED CAPITAL:		
2.95% note payable, due June 1, 1967 (annual prepayments of $1,000,000 each June 1 from 1956 to 1966)	$ 14,500,000	$ 15,500,000
3½% notes payable, due March 1, 1972 (annual prepayments each March 1 from 1957 to 1971 ranging from $500,000 to $1,250,000)	20,000,000	20,000,000
	34,500,000	35,500,000
EQUITY CAPITAL AND EARNINGS RETAINED IN BUSINESS — Note 1:		
Capital stock —		
Common A stock of no par value, stated at $25 per share, authorized 3,000,000 shares, issued 594,786 shares (preference on liquidation $75 per share or $44,455,655 on 592,742.1 shares outstanding)	14,869,650	14,869,650
Common B stock at $1 par value, authorized and issued 3,000,000 shares	3,000,000	3,000,000
Capital surplus	12,902,432	12,902,432
Earnings retained in the business (as of December 31, 1955 $63,249,269 was restricted as to payment of dividends on capital stock under loan agreement)	76,690,067	72,473,104
	107,462,149	103,245,186
Deduct — Stock held in treasury —		
Common A stock 2,043.9 shares, at cost	116,352	116,322
Common B stock 950,000 shares at par value of $1 per share (cost $1,900,000)	950,000	950,000
	1,066,352	1,066,322
Total equity capital and earnings retained in the business	106,395,797	102,178,864
SOURCES FROM WHICH NET ASSETS WERE PROVIDED	$140,895,797	$137,678,864

NOTES:

(1) The Certificate of Incorporation provides that dividends per share are to be paid on the capital stock only in the ratio of $10 for the Common A stock to $1 for the Common B stock. At December 31, 1955, title to 540,894 of the 592,742.1 outstanding shares of Common A stock and all of the outstanding Common B stock was vested in the Attorney General of the United States.

(2) At December 31, 1955, there were certain civil lawsuits and claims pending against the Company, as a result of which, in the opinion of management, no material loss will be sustained.

AUDITORS' CERTIFICATE

ARTHUR ANDERSEN & CO.
67 Broad Street
New York 4

To the Stockholders and Board of Directors,
General Aniline & Film Corporation:

We have examined the statement of consolidated financial position of General Aniline & Film Corporation (a Delaware corporation) and subsidiary companies as of December 31, 1955, and the related statements of consolidated earnings and earnings retained in the business for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. We had made a similar examination for the year ended December 31, 1954.

In our opinion, the accompanying statement of consolidated financial position and statements of consolidated earnings and earnings retained in the business present fairly the financial position of General Aniline & Film Corporation and subsidiary companies as of December 31, 1955, and the results of their operations for the year then ended, and were prepared in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Arthur Andersen & Co.

New York, N. Y.,
February 27, 1956.

FIVE YEAR STATISTICAL SUMMARY

(DOLLARS SHOWN ARE IN THOUSANDS)

	1951	1952	1953	1954	1955
Sales	$107,612	$107,621	$109,600	$104,964	$121,248
Earnings before taxes	13,295	6,473	6,303	5,029	8,935
Federal income and excess profits taxes	8,077	2,300	3,345	2,510	4,718
Net earnings after taxes	5,218	4,173	2,958	2,519	4,217
Stockholders' Equity	94,551	97,991	100,203	102,179	106,396
Current assets	91,138	96,816	98,470	97,662	95,656
Current liabilities	17,501	11,693	12,626	12,387	16,253
Net working capital	73,637	85,123	85,844	85,275	79,403
Earnings retained in the business (cumulative)	64,846	68,285	70,497	72,473	76,690
Property, plant and equipment (net)	48,972	49,703	49,650	49,743	58,508
Long term debt	30,000	39,000	38,000	35,500	34,500
Number of employees	9,349	8,242	8,462	8,190	8,190
Payroll	41,179	37,838	39,590	39,168	41,849

NOTE: The consolidated data for 1952 and 1951, as shown in the annual reports for those years have been restated in the above summary to reflect consolidation of subsidiaries, allocations to the appropriate year of entries originally made directly to earnings retained in the business, and other adjustments.

PRODUCTS

Dyestuff and Chemical Division	Dyes and Pigments, Intermediates for the dye, pharmaceutical and other industries, Acetylene Chemicals, Surfactants (surface active agents including detergents, wetting agents and emulsifiers), Carbonyl Iron Powders, Chlorine, Caustic Soda, Caustic Potash, Chelating Agents (metal sequestering), Textile and Rubber Chemicals, Optical Bleaches, Ultra Violet Absorbers, Corrosion Inhibitors, Chemicals used in crude oil production and Germicides.
Ansco Division	Photographic Products, including black and white roll film, Motion Picture film, Portrait, X-ray, and Graphic Arts films, Paper and Chemicals. Anscochrome color films, Printon and other color photo products, Chemicals and Darkroom Equipment and Supplies. Cameras and Accessories.
Ozalid Division	Whiteprint Duplicating Machines. Sensitized materials including papers, cloths, foils and glass fibers. Ozalith positive paper and aluminum plates for Offset Duplicating.

OFFICES AND PLANTS

Executive	230 PARK AVENUE, NEW YORK 17, N. Y.
Divisional	ANSCO DIVISION Binghamton, N. Y. Atlanta, Ga.; Boston, Mass.; Chicago, Ill.; Dallas, Texas; Detroit, Mich.; Hollywood, Calif.; Los Angeles, Calif.; New York, N. Y.; San Francisco, Calif.; Union, N. J.; Washington, D. C. and Toronto, Canada. OZALID DIVISION Johnson City, N. Y. Atlanta, Ga.; Chicago, Ill.; Dallas, Texas; Detroit, Mich.; Indianapolis, Ind.; Los Angeles, Calif.; Milwaukee, Wisc.; New York, N. Y.; Oakland, Calif.; Rochester, N. Y.; San Francisco, Calif.; St. Louis, Mo.; Schenectady, N. Y.; Syracuse, N. Y. and Washington, D. C. DYESTUFF AND CHEMICAL DIVISION (General Dyestuff Company-Antara Chemicals) 435 Hudson Street, New York 14, N. Y. Boston, Mass.; Charlotte, N. C.; Chattanooga, Tenn.; Chicago, Ill.; Los Angeles, Calif.; Philadelphia, Pa.; Portland, Ore.; Providence, R. I.; San Francisco, Calif.; Houston, Texas and Alameda, Calif.
Plants	Linden, N. J.; Rensselaer, N. Y.; Calvert City, Ky.; Huntsville, Ala.; Binghamton, N. Y.; Johnson City, N. Y. and Oakland, Calif.
Research Laboratories	Easton, Pa.; Linden, N. J.; Rensselaer, N. Y.; Binghamton, N. Y. and Johnson City, N. Y.

DIRECTORS

NORMAN BILTZ
Reno, Nevada

ELMER H. BOBST
New York City

LUCIUS D. CLAY
New York City

T. COLBURN DAVIS
New York City

MELVIN C. EATON
Norwich, N. Y.

HORACE C. FLANIGAN
New York City

JAMES FORRESTAL
Binghamton, N. Y.

FRANCIS A. GIBBONS
New York City

ROBERT HELLER
Cleveland, Ohio

JOHN HILLDRING
New York City

THOMAS A. MORGAN
New York City

WINSTON PAUL
New York City

ARTHUR E. PETTIT
New York City

G. SCHUYLER TARBELL, JR.
New York City

ROBERT R. WILLIAMS
New York City

OFFICERS

JOHN HILLDRING
President

FRANCIS A. GIBBONS
Senior Vice President

PHILIP M. DINKINS
Vice President — Operations
Dyestuff & Chemical Division

LEOPOLD F. ECKLER
Vice President-General Manager
Ansco Division

JAMES FORRESTAL
Vice President — Ansco-Ozalid

MATTHEW M. GOUGER
Vice President — Personnel Relations

WALTER A. HENSEL
Vice President-General Manager
Ozalid Division

CHANDLER T. WHITE
Vice President — Trade Relations

SUMNER H. WILLIAMS
Vice President — Sales
Dyestuff & Chemical Division

ARTHUR J. YOUNG
Controller

ALBERT E. HENDERSHOT
Treasurer

C. JOSEPH HYLAND
Secretary

Transfer Agents

City Bank Farmers Trust Company
22 William Street, New York 15, N. Y.

Corporation Trust Company
15 Exchange Place, Jersey City 2, N. J.

Registrars

The Chase Manhattan Bank
18 Pine Street, New York 15, N. Y.

Commercial Trust Company of New Jersey
15 Exchange Place, Jersey City 2, N. J.

General Counsel

Winthrop, Stimson, Putnam & Roberts
New York

Resident Counsel

Herbert L. Abrons

FORM 7. STATEMENT OF FINANCIAL AFFAIRS

UNITED STATES BANKRUPTCY COURT
District of New Jersey

In Re: G-I Holdings, Inc.
Debtor

Case No.: 01-30135 (RG)

STATEMENT OF FINANCIAL AFFAIRS

This statement is to be completed by every debtor. Spouses filing a joint petition may file a single statement on which the information for both spouses is combined. If the case is filed under chapter 12 or chapter 13, a married debtor must furnish information for both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed. An individual debtor engaged in business as a sole proprietor, partner, family farmer, or self-employed professional, should provide the information requested on this statement concerning all such activities as well as the individual's personal affairs.

Questions 1 - 18 are to be completed by all debtors. Debtors that are or have been in business, as defined below, also must complete Questions 19 - 25. **If the answer to an applicable question is "None", mark the box labeled "None".** If additional space is needed for the answer to any question, use and attach a separate sheet properly identified with the case name, case number (if known), and the number of the question.

DEFINITIONS

"In business." A debtor is "in business" for the purpose of this form if the debtor is a corporation or partnership. An individual debtor is "in business" for the purpose of this form if the debtor is or has been, within the six years immediately preceding the filing of this bankruptcy case, any of the following: an officer, director, managing executive, or owner of 5% or more of the voting or equity securities of a corporation; a partner, other than a limited partner, of a partnership; a sole proprietor or self-employed.

"Insider." The term "insider" includes, but is not limited to; relatives of the debtor; general partners of the debtor and their relatives; corporations of which the debtor is an officer, director, or person in control; officers, directors, and any owner of 5% or more of the voting or equity securities of a corporate debtor and their relatives; affiliates of the debtor and insiders of such affiliates; any managing agent of the debtor. 11 U.S.C. § 101 (30).

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STATEMENT OF FINANCIAL AFFAIRS

GENERAL NOTES REGARDING THE STATEMENT OF FINANCIAL AFFAIRS

1. Current Market Value It would be prohibitively expensive and unduly burdensome to obtain current market valuations of the Debtor's property interests. Accordingly, unless otherwise indicated, net book values, rather than current market values, of the Debtor's interests in property are reflected on the Debtor's Statement of Financial Affairs.

2. Accuracy While every effort has been made to file complete and accurate Schedules, inadvertent errors or omissions may exist. The Debtor reserves the right to amend its Statement of Financial Affairs as necessary or appropriate.

3. Dates Unless otherwise indicated, all amounts are listed as of January 5, 2001, the day the Debtor commenced its chapter 11 case (the "Commencement Date")

None
[ ]

1. Income from employment or operation of business

State the gross amount of income the debtor has received from employment, trade, or profession, or from the operations of the debtor's business from the beginning of this calendar year to the date this case was commenced. State also the gross amount received during the two years immediately preceding this calendar year. (A debtor that maintains, or has maintained, financial records on the basis of a fiscal rather than a calendar year may report fiscal year income. Identify the beginning and ending dates of the debtor's fiscal year.) If a joint petition is filed, state income for each spouse separately. (Married debtors filing under chapter 12 or chapter 13 must state income of both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

AMOUNT	SOURCE
$16,674,000	1999 Net Income from Debtor's Business
$6,864,000	2000 Net Income from Debtor's Business
($2,787,000)	January 1 - January 5, 2001 Net Income from Debtor's Business

None
[X]

2. Income other than from employment or operation of business

State the amount of income received by the debtor other than from employment, trade, profession, or operation of the debtor's business during the two years immediately preceding the commencement of this case. Give particulars. If a joint petition is filed, state income for each spouse separately. (Married debtors filing under chapter 12 or chapter 13 must state income for each spouse whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

AMOUNT	SOURCE

None
[ ]

3. Payments to creditors

a. List all payments on loans, installment purchases of goods or services, and other debts, aggregating more than $600 to any creditor, made within 90 days immediately preceding the commencement of this case. (Married debtor filing under chapter 12 or chapter 13 must include payments by either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OF CREDITOR	DATES OF PAYMENTS	AMOUNT PAID	AMOUNT STILL OWING

See Attachment 3a

None
[ ]

b. List all payments made within one year immediately preceding the commencement of this case to or for the benefit of creditors who are or were insiders. (Married debtors filing under chapter 12 or chapter 13 must include payments by either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OF CREDITOR AND RELATIONSHIP TO DEBTOR	DATES OF PAYMENTS	AMOUNT PAID	AMOUNT STILL OWING

See Attachment 3b

None
[ ]

4. Suits and administrative proceedings, executions, garnishments, and attachments

a. List all suits and administrative proceedings to which the debtor is or was a party within one year immediately preceding the filing of this bankruptcy case. (Married debtors filing under chapter 12 or chapter 13 must include information concerning either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

CAPTION OF SUIT AND CASE NUMBER	NATURE OF PROCEEDING	COURT OR AGENCY LOCATION	STATUS OF DISPOSITION

See Attachment 4a-1 and 4a-2 for litigation, and refer to the enclosed CD for detailed information relating specifically to asbestos litigation.

None
[X]

b. Describe all property that has been attached, garnished or seized under any legal or equitable process within one year immediately preceding the commencement of this case. (Married debtors filing under chapter 12 or chapter 13 must include information concerning property of either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OF PERSON FOR WHOSE BENEFIT PROPERTY WAS SEIZED	DATE OF SEIZURE	DESCRIPTION AND VALUE OF PROPERTY

None
[X]

5. Repossessions, foreclosures, and returns

List all property that has been repossessed by a creditor, sold at a foreclosure sale, transferred through a deed in lieu of foreclosure or returned to the seller, within one year immediately preceding the commencement of this case. (Married debtors filing under chapter 12 or chapter 13 must include information concerning property of either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OF CREDITOR OR SELLER	DATE OF REPOSSESSION, FORECLOSURE SALE, TRANSFER OR RETURN	DESCRIPTION AND VALUE OF PROPERTY

None
[X]

6. Assignments and receiverships

a. Describe any assignment of property for the benefit of creditors made within 120 days immediately preceding the commencement of this case. (Married debtors filing under chapter 12 or chapter 13 must include any assignment by either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OF ASSIGNEE	DATE OF ASSIGNMENT	TERMS OF ASSIGNMENT OR SETTLEMENT

None
[X]

b. List all property which has been in the hands of a custodian, receiver, or court-appointed official within one year immediately preceding the commencement of this case. (Married debtors filing under chapter 12 or chapter 13 must include information concerning property of either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OF CUSTODIAN	NAME AND LOCATION OF COURT, CASE TITLE & NUMBER	DATE OF ORDER	DESCRIPTION AND VALUE OF PROPERTY

None
[ ]

7. Gifts

List all gifts or charitable contributions made within one year immediately preceding the commencement of this case except ordinary and usual gifts to family members aggregating less than $200 in value per individual family member and charitable contributions aggregating less than $100 per recipient. (Married debtors filing under chapter 12 or chapter 13 must include gifts or contributions by either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OR PERSON OR ORGANIZATION	RELATIONSHIP TO DEBTOR, IF ANY	DATE OF GIFT	DESCRIPTION AND VALUE OF GIFT
National Republican Congressional Committee 320 First St SE Washington, DC		2/25/2000	$100,000
National Republican Senatorial Committee 320 First Street NE Washington, DC		2/18/2000	$50,000
Democratic National Committee 430 South Capital St SE Washington, DC 20003		10/13/2000	$50,000
Democratic Leadership Council		2/22/2000	$15,000
Wish List PAC		2/9/2000	$10,000
One New Jersey		2/9/2000	$10,000
Committee for New Jersey's Future		2/9/2000	$3,000

None [X] **8. Losses**

List all losses from fire, theft, other casualty, or gambling within one year immediately preceding the commencement of this case or since the commencement of this case. (Married debtors filing under chapter 12 or chapter 13 must include losses by either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

DESCRIPTION AND VALUE OF PROPERTY	DESCRIPTION OF CIRCUMSTANCES AND, IF LOSS WAS COVERED IN WHOLE OR IN PART BY INSURANCE, GIVE PARTICULARS	DATE OF LOSS

None [ ] **9. Payments related to debt counseling or bankruptcy**

List all payments made or property transferred by or on behalf of the debtor to any persons, including attorneys, for consultation concerning debt consolidation, relief under the bankruptcy law or preparation of a petition in bankruptcy within one year immediately preceding the commencement of this case.

NAME AND ADDRESS OF PAYEE	DATE OF PAYMENT, NAME OF PAYOR, IF OTHER THAN DEBTOR	AMOUNT OF MONEY OR DESCRIPTION AND VALUE OF PROPERTY
Arthur Andersen, LLP 1345 Avenue of the American New York, New York 10105	January 4, 2001	$200,000.00
Weil, Gotshal, & Manges LLP 767 Fifth Avenue New York, New York 10153	August 23, 2000 October 20, 2000 October 20, 2000 November 7, 2000 November 7, 2000 November 7, 2000 December 7, 2000 January 4, 2001	$25,372.14 7,767.96 5,999.46 31,807.70 21,952.69 900,000.00 112,337.70 5,662.00
Riker, Danzig, Scherer, Hyland & Perretti, LLP Headquarters Plaza One Speedwell Avenue Morristown, NJ 07962-1981	January 4, 2001	$100,000.00

None [X] **10. Other transfers**

a. List all other property, other than property transferred in the ordinary course of the business or financial affairs of the debtor, transferred either absolutely or as security within one year immediately preceding the commencement of this case. (Married debtors filing under chapter 12 or chapter 13 must include transfers by either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OF TRANSFEREE, RELATIONSHIP TO DEBTOR	DATE	DESCRIBE PROPERTY TRANSFERRED AND VALUE RECEIVED

None **11. Closed financial accounts**
[ ]

List all financial accounts and instruments held in the name of the debtor or for the benefit of the debtor which were closed, sold, or otherwise transferred within one year immediately preceding the commencement of this case. Include checking, savings, or other financial accounts, certificates of deposit, or other instruments, shares and share accounts held in banks, credit unions, pension funds, cooperatives, associations, brokerage houses and other financial institutions. (Married debtors filing under chapter 12 or chapter 13 must include information concerning accounts or instruments held by or for either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OF INSTITUTION	TYPE AND NUMBER OF ACCOUNT AND AMOUNT OF FINAL BALANCE	AMOUNT AND DATE OF SALE OR CLOSING
Bank of New York Newark, DE 19714	Payroll Account A/C # 0300976891 Balance at closing = $0	March 6, 2000
Summit Bank 109 Hamburg Turnpike Wayne, NJ 07470	Money Market Account A/C # 4058028174 Balance at closing = $0	December, 2000

None **12. Safe deposit boxes**
[ ]

List each safe deposit or other box or depository in which the debtor has or had securities, cash, or other valuables within one year immediately preceding the commencement of this case. (Married debtors filing under chapter 12 or chapter 13 must include boxes or depositories of either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OF BANK OR OTHER DEPOSITORY	NAMES AND ADDRESSES OF THOSE WITH ACCESS TO BOX OR DEPOSITORY	DESCRIPTION OF CONTENTS	DATE OF TRANSFER OR SURRENDER, IF ANY
Summit Bank 109 Hamburg Turnpike Wayne, NJ 07470	Susan Yoss Barry Belfer Art Clark 1361 Alps Road Wayne, NJ 07470	G-I Holdings, Inc. stock certificates	

None **13. Setoffs**
[X]

List all setoffs made by any creditor, including a bank, against a debt or deposit of the debtor within 90 days preceding the commencement of this case. (Married debtors filing under chapter 12 or chapter 13 must include information concerning either or both spouses whether or not a joint petition is filed, unless the spouses are separated and a joint petition is not filed.)

NAME AND ADDRESS OF CREDITOR	DATE OF SETOFF	AMOUNT OF SETOFF

None
[X]

14. Property held for another person

List all property owned by another person that the debtor holds or controls.

NAME AND ADDRESS OF OWNER	DESCRIPTION AND VALUE OF PROPERTY	LOCATION OF PROPERTY

None
[X]

15. Prior address of debtor

If the debtor has moved within the two years immediately preceding the commencement of this case, list all premises which the debtor occupied during that period and vacated prior to the commencement of this case. If a joint petition is filed, report also any separate address of either spouse.

ADDRESS	NAME USED	DATES OF OCCUPANCY

None

16. Spouses and Former Spouses

[X] If the debtor resides or resided in a community property state, commonwealth, or territory (including Alaska, Arizona, California, Idaho, Louisiana, Nevada, New Mexico, Puerto Rico, Texas, Washington, or Wisconsin) within the six-year period immediately preceding the commencement of the case, identify the name of the debtor's spouse and of any former spouse who resides or resided with the debtor in the community property state.

NAME

17. Environmental Information.

For the purpose of this question, the following definitions apply:

"Environmental Law" means any federal, state, or local statute or regulation regulating pollution, contamination, releases of hazardous or toxic substances, wastes or material into the air, land, soil, surface water, groundwater, or other medium, including, but not limited to , statutes or regulating the cleanup of these substances, wastes, or material.

"Site" means any location, facility, or property as defined under any Environmental Law, whether or not presently or formerly owned or operated by the debtor, including, but not limited to, disposal sites.

"Hazardous Material" means anything defined as a hazardous waste, hazardous substance, toxic substance, hazardous material, pollutant, or contaminant or similar term under an Environmental Law

---

None [ ]

a. List the name and address of every site for which the debtor has received notice in writing by a governmental unit that it may be liable or potentially liable under or in violation of an Environmental Law. Indicate the governmental unit, the date of the notice, and, if known, the Environmental Law:

SITE NAME AND ADDRESS	NAME AND ADDRESS OF GOVERNMENTAL UNIT	DATE OF NOTICE	ENVIRONMENTAL LAW

See Attachment 17a for additional litigation.

None [ ]

b. List the name and address of every site for which the debtor provided notice to a governmental unit of a release of Hazardous Material. Indicate the governmental unit to which the notice was sent and the date of the notice.

SITE NAME AND ADDRESS	NAME AND ADDRESS OF GOVERNMENTAL UNIT	DATE OF NOTICE	ENVIRONMENTAL LAW
South Bound Brook - Canal Road, South Bound Book, Somerset, NJ	New Jersey Department of Environmental Protection., 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	January 21, 1986	NJ Spill Compensation and Control Act
South Bound Brook - Main Street., South Bound Brook, NJ	New Jersey Department of Environmental Protection., 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	June 29, 1985	NJ Spill Compensation and Control Act
Gloucester City Landfill., Gloucester City, NJ	New Jersey Department of Environmental Protection., 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	March 1990	NJ Spill Compensation and Control Act

None [ ]

c. List all judicial or administrative proceedings, including settlements or orders, under any Environmental Law with respect to which the debtor is or was a party. Indicate the name and addresses of the governmental unit that is or was a party to the proceeding, and the docket number.

NAME AND ADDRESS OF GOVERNMENTAL UNIT	DOCKET NUMBER	STATUS OR DISPOSITION

See Attachment 17c for additional details

None a.
[ ]

18. Nature, location and name of business

If the debtor is an individual, list the names, addresses, taxpayer identification numbers, nature of the businesses, and beginning and ending dates of all businesses in which the debtor was an officer, director, partner, or managing executive of a corporation, partnership, sole proprietorship, or was a self-employed professional within the six years immediately preceding the commencement of this case, or in which the debtor owned 5 percent or more of the voting or equity securities with the six years immediately preceding the commencement of this case.

If the debtor is a partnership, list the names, addresses, taxpayer identification numbers, nature of the businesses, and beginning and ending dates of all businesses in which the debtor was a partner or owned 5 percent or more of the voting or equity securities, within the six years immediately preceding the commencement of this case.

If the debtor is a corporation, list the names, addresses, taxpayer identification numbers, nature of the businesses, and beginning and ending dates of all businesses in which the debtor was a partner or owned 5 percent or more of the voting or equity securities, within the six years immediately preceding the commencement of this case.

NAME	TAXPAYER I.D. NUMBER	ADDRESS	NATURE OF BUSINESS	BEGINNING AND ENDING DATES
GAF Corporation	13-3446412	200 Delaware Avenue Suite 300 Wilmington, Delaware, 19801	Holding Company	September 2, 1987- November 15, 2000 (Merger Date)
GAF Fiberglass Corp.	22-2934580	1361 Alps Road Wayne, NJ 07470	Holding Company	September 23, 1987- October 31, 2000 (Merger Date)
G Industries Corp	13-3467205	200 Delaware Avenue Suite 300 Wilmington, Delaware 19801	Holding Company	September 23, 1987 October 31, 2000 (Merger Date)
HMCA Holdings Corporation	51-0393774	300 Delaware Avenue Suite 303 Wilmington, Delaware, 19801	Holding Company	September 9, 1999- Present
ACI, Inc.	58-1359425	818 Washington Street Wilmington, Delaware, 19801	Holding Company	June 6, 1978-Present
Bwater Corp.	22-2944732	1361 Alps Road Wayne, New Jersey, 07470	Real Estate Holding Company	September 23, 1987- Present
GAF Roofing Manufacturing Corporation c/o GAF Fiberglass Corp.	22-3225598	1361 Alps Road Wayne, New Jersey, 07470	Inactive	March 17, 1993- Present
General Aniline & Film Corp . c/o GAF Fiberglass Corp	13-2600886	1361 Alps Road Wayne, New Jersey, 07470	Inactive	December 6, 1967- Present
Merick, Inc.	22-2934574	818 Washington Street Wilmington, Delaware, 19801	Holding Company	September 23, 1987- Present
GAF Building Materials Corporation	22-2934562	1361 Alps Road Wayne, New Jersey, 07470	Holding Company	September 23, 1987- Present

None [X] b. Identify any business listed in response to subdivision a., above, that is "single asset real estate" as defined in 11 U.S.C. § 101.

NAME	ADDRESS

The following questions are to be completed by every debtor that is a corporation or partnership and by any individual debtor who is or has been, within the six years immediately preceding the commencement of this case, any of the following: an officer, director, managing executive, or owner of more than 5 percent of the voting or equity securities of a corporation; a partner, other than a limited partner, of a partnership; a sole proprietor or otherwise self-employed.

(An individual or joint debtor should complete this portion of the statement only if the debtor is or has been in business, as defined above, within the six years immediately preceding the commencement of this case. A debtor who has not been in business within those six years should go directly to the signature page.)

None [ ]

19. Books, records, and financial statements

a. List all bookkeepers and accountants who within the two years immediately preceding the filing of this bankruptcy case kept or supervised the keeping of books of accounts and records of debtor.

NAME AND ADDRESS	DATES SERVICES RENDERED
Ray Harris 1361 Alps Road Wayne, New Jersey, 07470	April 2000 - Present
Jeanne Narkiewicz 1361 Alps Road Wayne, New Jersey, 07470	October 1995 – March 2000
Andy Diamond 1361 Alps Road Wayne, New Jersey, 07470	1993– March 2000

None [X]

b. List all firms or individuals who within the two years immediately preceding the filing of this bankruptcy case have audited the books of account and records, or prepared a financial statement of the debtor.

NAME	ADDRESS	DATES SERVICES RENDERED

None
[X]
c. List all firms or individuals who at the time of the commencement of this case were in possession of the books of account and records of the debtor. If any of the books of account and records are not available, explain.

NAME	ADDRESS

None
[ ]
d. List all financial institutions, creditors, and other parties, including mercantile and trade agencies, to whom a financial statement was issued within the two years immediately preceding the commencement of this case by the debtor.

NAME AND ADDRESS	DATE ISSUED
Alwyn H. Luckey, Esq. P.O. Box 724 2016 Bienville Blvd. Ocean Springs, MS 39566-0724	September 12, 2000

None
[X]
20. Inventories

a. List the dates of the last two inventories taken of your property, the name of the person who supervised the taking of each inventory, and the dollar amount and basis of each inventory.

DATE OF INVENTORY	INVENTORY SUPERVISOR	DOLLAR AMOUNT OF INVENTORY (Specify cost, market or other basis)

None
[X]
b. List the name and address of the person having possession of the records of each of the two inventories reported in a. above.

DATE OF INVENTORY	NAME AND ADDRESS OF CUSTODIAN OR INVENTORY RECORDS

None [X]

21. Current Partners, Officers, Directors, and Shareholders

a. If the debtor is a partnership, list the nature and percentage of partnership interest of each member of the partnership.

NAME AND ADDRESS	NATURE OF INTEREST	PERCENTAGE OF INTEREST

None [ ]

b. If the debtor is a corporation, list all officers and directors of the corporation, and each stockholder who directly or indirectly owns, controls, or holds 5 percent or more of the voting or equity securities of the corporation.

NAME AND ADDRESS	TITLE	NATURE AND PERCENTAGE OF STOCK OWNERSHIP
William W. Collins 1361 Alps Rd Wayne, NJ 07470	Board of Directors	
Samuel J. Heyman 1361 Alps Rd Wayne, NJ 07470	Board of Directors	Beneficially owns (as defined by Rule 13d-3 of the Exchange Act) approximately 99% of the capital stock of G-I Holdings Inc
Richard A. Weinberg 1361 Alps Rd Wayne, NJ 07470	Chief Executive Officer, President General Counsel and Secretary, Board of Directors	
Susan B. Yoss 1361 Alps Rd Wayne, NJ 07470	Senior Vice President, Chief Financial Officer & Treasurer	
Paul J. Aronson 1361 Alps Rd Wayne, NJ 07470	Senior Vice President – Taxes	
Peter J. Ganz 1361 Alps Rd Wayne, NJ 07470	Vice President, Legal Affairs and Deputy General Counsel	
Michael J. Baker 1361 Alps Rd Wayne, NJ 07470	Assistant Secretary	
Alvin M. Yanofsky 1361 Alps Rd Wayne, NJ 07470	Assistant Secretary	

None
[X]

22. Former partners, officers, directors, and shareholders

a. If the debtor is a partnership, list each member who withdrew from the partnership within one year immediately preceding the commencement of this case.

NAME	ADDRESS	DATE OF WITHDRAWAL

None
[ ]

b. If the debtor is a corporation, list all officers, or directors whose relationship with the corporation terminated within one year immediately preceding the commencement of this case.

NAME AND ADDRESS	TITLE	DATE OF TERMINATION
Samuel J. Heyman	Chairman of the Board, Chief Executive Officer and President	9/11/00

None
[X]

23. Withdrawals from a partnership or distributions by a corporation

If the debtor is a partnership or corporation, list all withdrawals or distributions credited or given to an insider, including compensation in any form, bonuses, loans, stock redemptions, options exercised and any other perquisite during one year immediately preceding the commencement of this case.

NAME & ADDRESS OF RECIPIENT, RELATIONSHIP TO DEBTOR	DATE AND PURPOSE OF WITHDRAWAL	AMOUNT OF MONEY OR DESCRIPTION AND VALUE OF PROPERTY

None
[ ]

24. Tax Consolidation Group.

If the debtor is a corporation, list the names and federal taxpayer identification number of the parent corporation of any consolidated group for tax purposes of which the debtor has been a member at any time within the six-year period immediately preceding the commencement of the case.

NAME OF PARENT CORPORATION	TAXPAYER IDENTIFICATION NUMBER
GAF Corporation	13-3446412

None
[X]

25. Pension Funds.

If the debtor is not an individual, list the name and federal taxpayer identification number of any pension fund to which the debtor, as an employer, has been responsible for contributing at any time within the six-year period immediately preceding the commencement of the case.

NAME OF PENSION FUND	TAXPAYER IDENTIFICATION NUMBER

(If completed by an individual or individual and spouse)
I declare under penalty of perjury that I have read the answers contained in the foregoing statement of financial affairs and any attachments thereto and that they are true and correct.

Date ____N/A____ Signature of Debtor ____N/A____

Date ____N/A____ Signature of Joint Debtor (if any) ____N/A____

* * * * * *

(If completed on behalf of a partnership or corporation)

I, declare under penalty of perjury that I have read the answers contained in the foregoing statement of financial affairs and any attachments thereto and that they are true and correct to the best of my knowledge, information and belief.

Date ____________ Signature ____________

Richard A. Weinberg, President
Print Name and Title

(An individual signing on behalf of a partnership or corporation must indicate position or relationship to debtor.)

192 continuation sheets attached

Penalty for making a false statement: Fine of up to $500,000 or imprisonment for up to 5 years, or both. 18 U.S.C. Sections

152 and 3571.

SITE NAME AND ADDRESS	NAME AND ADDRESS OF GOVERNMENTAL UNIT	DATE OF NOTICE	ENVIRONMENTAL LAW
Hardage Landfill., McClain County, OK	Oklahoma Department of Environmental Quality., P.O. Box 1677 Oklahoma City, OK 73101-1677	May 10, 1990	Environmental Quality Code, 27A O.S. § 2-6-105 et seq.
Helen Kramer Landfill., Leave Road, Mantua Twp., NJ	New Jersey Department of Environmental Protection., 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	February 23, 1988	NJ Spill Compensation & Control Act.
Heleva Landfill., Ormod & Ironton, PA	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	January 27, 1988	CERCLA
Hinson ., Clover, SC.	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	June 26, 1995	CERCLA
Insta-Foam., Broadway St., Crest Hill, IL	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	January 23, 1989	CERCLA
International Paper., Binghamton, NY	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	March 12, 1995	CERCLA
Jonas Transfer Station., Deptford Township, NJ	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	May 1, 1990	CERCLA
Kane & Lombard., Kane & Lombard Streets, Baltimore, MD	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	December 14, 1987	CERCLA
Kin-Buc., 383 Meadow Road, Edison, NJ	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	January 11, 1984	CERCLA
Kin-Buc/Kenney., Edison, NJ	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	August 22, 1984	CERCLA
Kin-Buc/Transtech., Edison, NJ	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	November 7, 1980	CERCLA
LCP Property., S. Wood Ave., Linden, NJ	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460 & U.S. Department of Justice	December 1995	CERCLA
Linden Facility., Linden, NJ	New Jersey Department of Environmental Protection., 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	January 24, 1986	NJ Spill Compensation & Control Act.; ECRA (ISRA)
Loeffel Landfill., Nassau, NY	New York Department of Environmental Conservation., 50 Wolf Road, Albany, NY 12233-1011	July 18, 1995	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act.
Lone Pine Landfill., Freehold, NJ	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C 20460	September 12, 1984	CERCLA
Lawrence., Calvert City, KY	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	June 2, 1989	CERCLA
Lowry Site., Aurora, CO	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	September 4, 1983	CERCLA
Maline Creek., Riverview, MO	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	April 28, 1993	CERCLA
Maryland Sand, Gravel & Stone., Pulaski Hwy., Elkton, MD	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	February, 1986	CERCLA
Mathis Brothers Landfill., Walker County, GA	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	August 14, 1984	CERCLA
Maxey Flats., Morehead, KY	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	November 26, 1986	CERCLA
McCarty's Bald Knob., Bald Top Rd., Mt Vernon, IN	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	April 27, 1987	CERCLA
Metro Container., West Second Street and Price Road, Trainer, PA	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	February 6, 1990	CERCLA
Middlesex Landfill., Mountain Ave., Middlesex, NJ	New Jersey Department of Environmental Protection., 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	December 16, 1994	NJ Spill Compensation & Control Act.

Exhibit J

In Re: G-I Holdings Inc. *Case No: 01-30135 (RG)*

Statement of Financial Affairs
Environmental Information *Attachment 17A*

SITE NAME AND ADDRESS	NAME AND ADDRESS OF GOVERNMENTAL UNIT	DATE OF NOTICE	ENVIRONMENTAL LAW
3353 San Fernando Rd., Los Angeles, CA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	January 16, 1997	CERCLA
68th Street Dump., Baltimore County, MD	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	April 21, 1997	CERCLA
8585 Hall Blvd., Beaverton, OR	Oregon Department of Environmental Quality 811 SW Sixth Avenue.,Portland, OR 97204	May 14, 1998	Toxic Use Reduction and Hazardous Waste Reduction Act.
Adkisson v. Dupont., WV	Unknown	Unknown	Unknown
American Felt & Filter., Newburgh, Township, NY	New York Department of Environmental Conservation., 50 Wolf Road, Albany, NY 12233-1011	10/1991 & 5/13/1994	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act.
Amnicola, Chattanooga, TN	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460 & Tennessee Department of Environmental Conservation, 344 Cordell Hall Building, Nashville, TN 37247-0101	November 22, 1985	CERCLA & TN Hazardous Waste Management Act of 1983
Archem, Houston, TX	Texas Water Commission, 3000 Bank One Center 1717 Main Street, Dallas, Texas 75201-4335	April 1, 1993	Superfund Site Discovery and Assessment Program, 30 TAC Chapter 335 Subchapter K
Artel Chemical, Nitro, WV	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	April 20, 1989	CERCLA
BASF, Riverside Ave, Rensselaer, NY	New York Department of Environmental Conservation, 50 Wolf Road, Albany, NY 12233-1011	April 26, 1986	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act.
Bay Drums, State Rd., Tampa, FL	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	January 6, 1994	CERCLA
Boarhead Farms, Bridgeton Township, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	June 13, 1988	CERCLA
Borne Chemical, Elizabeth, NJ	3rd Party Complaint	June 1, 1997	N/A
Butler Tunnel, Pittston City, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December 30, 1985	CERCLA
Cannon Engineering Corp., Plymouth, MA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December 30, 1982	CERCLA
Carolawn, Fort Lawn, SC	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	May 25, 1994	CERCLA
CEC Bridgewater, Bridgewater Township, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	March 2, 1987	NJ Spill Compensation and Control Act.
Chandler & Chandler v. Nova., Chattanooga, TN	Tennessee Department of Environmental Conservation, 344 Cordell Hall Building, Nashville, TN 37247-0101	January 31, 1997	TN Hazardous Waste Management Act.
Charles St., Binghamton, NY	New York Department of Environmental Conservation, 50 Wolf Road, Albany, NY 12233-1011	December 6, 1983	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act
Chemical Control Corporation, 23 Front Street, Elizabeth, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	March 11, 1987	CERCLA
Chemical Control Corporation, 23 Front Street, Elizabeth, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402 & U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	March 11, 1987	NJ Spill Compensation and Control Act.
Chemsol, Fleming St., Piscataway, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	January 10,1992	CERCLA
Chickamanga Road, Walker County, GA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	August 14, 1984	CERCLA
Chrin Industrial Lane, Williams Township, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	October 11, 1984	CERCLA

In Re: G-I Holdings Inc. *Case No: 01-30135 (RG)*

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Environmental Information *Attachment 17A*

SITE NAME AND ADDRESS	NAME AND ADDRESS OF GOVERNMENTAL UNIT	DATE OF NOTICE	ENVIRONMENTAL LAW
Cinnaminson Landfill (A/K/A SC Holdings), Cinnaminson, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December, 1995	CERCLA
Route 146A Barrel Site, Clifton Park, NY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	1983	CERCLA
Colesville Landfill, Colesville, NY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	July 26, 1984	CERCLA
Colesville Landfill, Colesville, NY	New York Department of Environmental Conservation, 50 Wolf Road, Albany, NY 12233-1011	March 1, 1985	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act
Lower Landfills, Allen Township, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December 12, 1983	CERCLA
Danmark Site	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	Unknown	CERCLA
Distler Farm & Brickyard, Louisville, KY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	November 12, 1985	CERCLA
Dorney Road/Oswalds Landfill, Upper Macungie Township, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	July 20, 1989	CERCLA
Dorney Road/Oswalt's Landfill, Lehigh, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	9/2/88 for Dorney, 10/11/88 for Oswalt	CERCLA
East Bethel, 217th Avenue, N.E., East Bethel Twp., MN	Minnesota PCA., 520 Lafayette Road, St. Paul, MN 55155-4194	August 4, 1986	Unknown
EMPAK(Martinez V. ARCO Site), Harris County, TX	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 25, 1991	CERCLA
EnviroChem, 865 South US 421, Zionsville, IN	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	March 23, 1983	CERCLA
Erie Plant, Erie County, PA	Pennsylvania Department of Environmental Resources, 4005 Market Street, Harrisburg, PA 17105	February 5, 1991	Hazardous Sites Cleanup Act.
Field's Brook, Ashtabula, OH	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	July 7, 1986	CERCLA
Findnett/Hayford Bridge, Governor Dr., St. Charles County, MO	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 28, 1988	CERCLA
Flowers., West Deptford Township, NJ	New Jersey Department of Environmental Protection., 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	April 26, 1989	NJ Spill Compensation and Control Act.
Franklin Realty(68th Street Dump)., Baltimore County, MD	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460. & 3rd Party	1/19/1999 & 3/21/1996	CERCLA & N/A
Frenkel, South Bound Brook, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	August 1, 1983	NJ Spill Compensation and Control Act.
Fru-Con, 9250 Riverview Dr., St. Louis, MO	Missouri Department of Natural Resources	September 29, 1997	Missouri Water Pollution Control Act., Voluntary Cleanup Program.
G.E.M.S. (a/k/a Amadel Liss Landfill & Amadel Sand & Gravel Landfill), Gloucester Twp.., NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	November 5, 1985	CERCLA
Gallup's Quarry, Tarbox Rd., Plainfield, CT	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460 & Connecticut Department of Environmental Protection, 70 Elm Street, Hartford, CT 06106-5127	March 11, 1990	CERCLA & Connecticut Hazardous Waste Disposal Act.E52 22A-133a-j et seq.
General Refining, Garden City, GA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 26, 1988	CERCLA
Glasco Site, Glasco, KS	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	Unknown	CERCLA

SITE NAME AND ADDRESS	NAME AND ADDRESS OF GOVERNMENTAL UNIT	DATE OF NOTICE	ENVIRONMENTAL LAW
Global Landfill, Old Bridge, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	February 6, 1991	NJ Spill Compensation and Control Act.
Gloucester City Landfill, Gloucester City, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	March 1990	NJ Spill Compensation and Control Act.
Hardage Landfill, McClain County, OK	Oklahoma Department of Environmental Quality, P.O. Box 1677 Oklahoma City, OK 73101-1677	May 10, 1990	Environmental Quality Code, 27A O.S. § 2-6-105 et seq.
Helen Kramer Landfill, Leave Road, Mantua Twp., NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	February 23, 1988	NJ Spill Compensation & Control Act.
Heleva Landfill, Ormod & Ironton, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	January 27, 1988	CERCLA
Hinson, Clover, SC.	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	June 28, 1995	CERCLA
Insta-Foam, Broadway St., Crest Hill, IL	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	January 23, 1989	CERCLA
International Paper, Binghamton, NY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	March 12, 1995	CERCLA
Jonas Transfer Station, Deptford Township, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	May 1, 1990	CERCLA
Kane & Lombard, Kane & Lombard Streets, Baltimore, MD	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December 14, 1987	CERCLA
Kin-Buc, 383 Meadow Road, Edison, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	January 11, 1984	CERCLA
Kin-Buc/Kenney, Edison, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	August 22, 1984	CERCLA
Kin-Buc/Transtech, Edison, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	November 7, 1980	CERCLA
LCP Property, S. Wood Ave., Linden, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460 & U.S. Department of Justice	December 1995	CERCLA
Linden Facility, Linden, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	January 24, 1986	NJ Spill Compensation & Control Act.; ECRA (ISRA)
Loeffel Landfill, Nassau, NY	New York Department of Environmental Conservation, 50 Wolf Road, Albany, NY 12233-1011	July 18, 1995	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act.
Lone Pine Landfill, Freehold, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 12, 1984	CERCLA
Lowrance, Calvert City, KY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	June 2, 1989	CERCLA
Lowry Site, Aurora, CO	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 4, 1983	CERCLA
Maline Creek, Riverview, MO	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	April 20, 1993	CERCLA
Maryland Sand, Gravel & Stone., Pulaski Hwy., Elkton, MD	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	February, 1986	CERCLA
Mathis Brothers Landfill., Walker County, GA	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	August 14, 1984	CERCLA
Maxey Flats., Morehead, KY	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	November 26, 1986	CERCLA
McCarty's Bald Knob., Bald Top Rd., Mt Vernon, IN	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	April 27, 1987	CERCLA

In Re: G-I Holdings Inc. *Case No: 01-30135 (RG)*

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Environmental Information *Attachment 17A*

SITE NAME AND ADDRESS	NAME AND ADDRESS OF GOVERNMENTAL UNIT	DATE OF NOTICE	ENVIRONMENTAL LAW
Metro Container, West Second Street and Price Road, Trainer, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	February 6, 1990	CERCLA
Middlesex Landfill, Mountain Ave., Middlesex, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	December 16, 1994	NJ Spill Compensation & Control Act.
Mill Creek, Erie, PA.	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 29, 1986	CERCLA
Millis Plant, 60 Curve St., Millis, MA	Massachusetts Department of Environmental Protection, 1 Winter Street Boston, MA 02108	November 9, 1989	Massachusetts Superfund Law (M.G.L. c. 21E)
Mobile Tank Car, 4135 Algonquin, Louisville, KY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 29, 1997	CERCLA
Morgan Materials, 373 Hertel Ave., Buffalo, NY.	New York Department of Environmental Conservation, 50 Wolf Road, Albany, NY 12233-1011 & U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	March, 1997	Environmental Conse+E72rvation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act.E84 & CERCLA
Motco, La Marque, TX	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460. & State of Texas	October 1984	CERCLA & Unknown
New Windsor, Silverstream Rd.,New Windsor, NY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	March 19, 1983	CERCLA
Noble Oil, Tabernacle, NJ	Unknown	Unknown	Unknown
North Hawthorne, Hamilton County, TN	Tennessee Department of Environmental Conservation, 344 Cordell Hall Building, Nashville, TN 37247-0101	December 19, 1994	TN Hazardous Waste Management Act of 1983
Novacor, Polymer Dr., Chattanooga, TN	Tennessee Department of Environmental Conservation., 344 Cordell Hall Building, Nashville, TN 37247-0101	March 16, 1993	TN Hazardous Waste Management Act of 1984
Novak, Orefield Rd. & Lapp Rd., South Whitehall Township, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 11, 1986	CERCLA
Oak Grove Landfill, Anoka County, MN	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	March 19, 1991	CERCLA
Odessa Drum, Odessa, TX	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 17, 1992	CERCLA
Old Forge(Iacavazzi), Lackawanna County, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December 2, 1985	CERCLA
Old Forge(Piccolini), Taylor and Ransom Township, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	February 13, 1987	CERCLA
Oliver Landfill, Waterford Township, Erie County, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460 & Pennsylvania Department of Environmental Resources, 4005 Market Street, Harrisburg, PA 17105	December 17, 1993	CERCLA & Hazardous Sites Cleanup Act.
Omega Chemical, Whittier, CA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	January 6, 1995	CERCLA
Operating Industries, 900 N. Potero Grande Drive, Monterey Park, CA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	Unknown	CERCLA
Organic Chemicals., 3291 Chicago Dr., Granville, MI	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	March 23, 1992	CERCLA
PAS Satellite-Clothier.,Granby, NY	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460 & New York Department of Environmental Conservation., 50 Wolf Road, Albany, NY 12233-1011	March 21, 1985	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act. & CERCLA
PAS Satellite-Fulton., Fulton, NY	U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460 & New York Department of Environmental Conservation., 50 Wolf Road, Albany, NY 12233-1011	March 21, 1985	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act. & CERCLA

SITE NAME AND ADDRESS	NAME AND ADDRESS OF GOVERNMENTAL UNIT	DATE OF NOTICE	ENVIRONMENTAL LAW
PAS Satellite-Oswego, E.Sececa St., Oswego, NY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460 & New York Department of Environmental Conservation., 50 Wolf Road, Albany, NY 12233-1011	March 1, 1982	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act. & CERCLA
PAS Satellite-Volney, Volney, NY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460 & New York Department of Environmental Conservation, 50 Wolf Road, Albany, NY 12233-1011	March 21, 1985	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act. & CERCLA
PB&S, Knoxville, TN	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December 11, 1995	CERCLA
Peak Oil, Hillsborough County, FL	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	June 25, 1991	CERCLA
Picillo, Piggy Hill Lane, Coventry, RI	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December 15, 1981	CERCLA
PJP Landfill, 400 Sip Ave., Jersey City, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	September 28, 1988	NJ Spill Compensation & Control Act.
Polak	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	April 22, 1991	NJ Spill Compensation & Control Act.
PPG, Jersey City, NJ	Unknown	Unknown	Unknown
Price's Pit., Pleasantville & Egg Harbor Twp., Atlantic City, NJ	New Jersey Department of Environmental Protection., 401 East State Street, P. O. 402, Trenton, NJ 08625-0402 & U.S. Environmental Protection Agency., 401 M Street, S.W., Washington, D.C. 20460	June 8, 1905	NJ Spill Compensation & Control Act. & CERCLA.
Reesers, Upper Macungie, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	April 6, 1988	CERCLA
Revere Chemicals, Route 61., Nockamixon Township, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 10, 1987	CERCLA
Riga/Foshie	Unknown	Unknown	Unknown
San Gabriel Valley, 6230 Irwindale Ave., Irwindale, CA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	January 1998	CERCLA
Sayreville Landfill, Jernee Mill Rd., Sayerville, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	April 22, 1991	NJ Spill Compensation & Control Act.
SCP/Berry's Creek, Carlstadt, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	October 1, 1989	CERCLA
SCP/Carlstadt, 219 Paterson Plank Rd., Carlstadt, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	May 17, 1985	CERCLA
SCP/Newark, 411 Wilson Ave., Newark, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	February 12, 1985	CERCLA
Seaboard Chemical, 5899 Riverdale Road, Jamestown, NC	NC Department of Environmental, Health & Natural Resources, 512 N.Salisbury St., Raleigh, NC 27604	July 10, 1991	N.C.G.S. Section 130A, Art. 9
Seymour Recycling, G Avenue West, Freeman Field, IN	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	July 14, 1987	CERCLA
Shavers Farm Landfill, Walker County, GA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	August 14, 1984	CERCLA
Sheridan, Clark Rd., Hempstead, TX	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 17, 1984	CERCLA
Silner Site, AL	Unknown	Unknown	Unknown

SITE NAME AND ADDRESS	NAME AND ADDRESS OF GOVERNMENTAL UNIT	DATE OF NOTICE	ENVIRONMENTAL LAW
Sitresim, 86 Tanner Street, Lowell, MA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December 9, 1983	CERCLA
Silsonix, 517 Lyons Ave., Irvington, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	April 27, 1992	CERCLA
South Bound Brook - Canal Road, South Bound Book, Somerset, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	January 21, 1986	NJ Spill Compensation and Control Act.
South Bound Brook - Main Street, South Bound Brook, NJ	New Jersey Department of Environmental Protection., 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	June 29, 1985	NJ Spill Compensation and Control Act.
South Bound Brook-Towpath, S. Bound Brook, NJ	New Jersey Department of Environmental Protection., 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	September 27, 1990	NJ Spill Compensation and Control Act.
South Marbletop Rd. Landfill, Walker County, GA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	August 14, 1984	CERCLA
Spectra Physics, Mountain View, CA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	June 24, 1988	CERCLA
Spectron/Galaxy, Inc., 111 Providence Road, Elkton, MD	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	June 30, 1989	CERCLA
Stein, University Avenue and Memorial Avenue, Gloucester City, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	1987	NJ Spill Compensation and Control Act.
Stotler(A/K/A Delta Quarries), Antis & Logan Twps., Blair County, PA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	June 1991	CERCLA
Sydney Mines, Brandon, FL	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	February 10, 1988	CERCLA
Syncon Resins, 77-81 Jacobus Ave., South Kearny, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 15, 1986	CERCLA
Tampa Stillyard, 5138 Madison Avenue, Tampa Bay, FL	Florida Department of Environmental Resources, 2600 Blairstone Road, MS 48 Tallahassee, FL 32399-2400	1983	Florida Air and Water Pollution Control Act, Fl. Stat. Sections 403.121(2) and 120.57(3)
Tate Cove, Evangeline Parish, LA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	August 18, 1982	CERCLA
Taylor Road, Seffner-Thorotosassa, FL	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	July 18, 1981	CERCLA
Tex Tin, Hwy 146 & Farm to Markey Rd. 519, Texas City, TX	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 18, 1989	CERCLA
Tri City Oil Conservationist Corp., Busch Boulevard and 50th Street, Temple Terrace, FL	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	November 7, 1989	CERCLA
Tri-City Barrel, Broome County, NY	New York Department of Environmental Conservation, 50 Wolf Road, Albany, NY 12233-1011	December 20, 1990	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act.
Tri-City Barrel, Broome County, NY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	May 23, 1991	CERCLA
U.S. Intec., Carvallis, Oregon	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 8, 1983	CERCLA
University Avenue, Gloucester City, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	June, 1987	NJ Spill Compensation and Control Act.
Vails Gate, Newburgh, NY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	May 3, 1984	CERCLA
Vanguard Vinyl, Gloucester City, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	November 27, 1992	CERCLA
Viewmaster, Beaverton, OR	Oregon Department of Environmental Quality 811 SW Sixth Avenue,Portland, OR 97204	Unknown	Toxic Use Reduction and Hazardous Waste Reduction Act.

SITE NAME AND ADDRESS	NAME AND ADDRESS OF GOVERNMENTAL UNIT	DATE OF NOTICE	ENVIRONMENTAL LAW
Waste Disposal Engineering (WDE) Site, Anoka County, MN	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December 30, 1982	CERCLA
Weld County Landfill, Weld County, CO	U.S. Environmental Protection Agency, Region 8 999-18th Street, Suite 300 Denver, CO 80202-2466	August 26, 1999	CERCLA
White Chemical Company, 660 Frelinghuysen Avenue, Newark, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	June 21, 1991	CERCLA
Woodlawn Landfill, Cecil County, MD	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	May 24, 1996	CERCLA
Atlantic Resources, 120 Horseshoe Road, Sayreville, NJ	U.S. Department of Justice, Environment and Natural Resources Division, P.O. Box 7611 Washington, D.C. 20044-7611	March 27, 2008	CERCLA
Bi-State Disposal, Route 3, Belleville, IL	Illinois Environmental Protection Agency, 1021 Notrth Grand Avenue East, PO Box 19276, Springfield, IL 62794-9276	June 9, 2003	Illinois Environmental Protection Act CERCLA
Casmalia Resources, Casmalia CA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	August 7, 2007	CERCLA
Cranston Sanitary Landfill, 1688 Pontiac Avenue, Cranston, RI 02920	Rhode Island Department of Environmental Management, 235 Promenade Street, Providence, RI 02908-5767	June 6, 2001	RI Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases, DEM-DSR-0101
Delps Road, Red Maple Drive, Village of Rockville, Lehigh Township, PA	Pennsylvania Department of Environmental Resources., 4005 Market Street, Harrisburg, PA 17105	June 14, 2008	Hazardous Sites Cleanup Act
Diamond Alkali, Newark Bay, New Jersey	U.S. Department of Justice, Environment and Natural Resources Division, P.O. Box 7611 Washington, D.C. 20044-7611	March 27, 2008	CERCLA
Gulf Metals, Almeda-Genoa Road and Mykowa Road, Houston, TX	Texas Natural Resource Conservation Commission (n/k/a) Texas Commission on Environmental Quality, Mail Code TCEQ PO Box 12087, Austin, TX 78711-3087	December 19, 2001	Texas Solid Waste Disposal Act
Kearny Municipal Sanitary Landfill (MSLA 1 D LF), 1500 Harrison Street, Kearny, NJ	New Jersey Department of Environmental Protection, 401 East State Street, P. O. 402, Trenton, NJ 08625-0402	May 31, 2001	NJ Spill Compensation and Control Act
LWD, Inc., Calvert City, KY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	August 19, 2008	CERCLA
Nyanza, Megunko Road, Ashland, MA	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	August 21, 1991	CERCLA
Pioneer Smelting Co., Inc., Railroad Ave, Chatsworth, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	December 22, 2006	CERCLA
Pollution Abatement Services - Clothier, South Granby Road, County Road 55, Town of Granby, NY	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460 & New York Department of Environmental Conservation, 50 Wolf Road, Albany, NY 12233-1011	March 21, 1985	Environmental Conservation Law, NY State Inactive Hazardous Waste Disposal Site Remediation Act & CERCLA
Renora, Inc., Edison, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	Before September 1984	CERCLA
Sylvester, Gilson Road, Nashua, NH	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	March 26, 1988	CERCLA
Tinkham Garage, Route 102, Londonderry, NH	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	March 28, 1986	CERCLA
US Radium, Alden and High Streets, Orange, NJ	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	April 16, 1985	CERCLA
Vermont Asbestos Group Mine Site, Mines Road, Eden and Lowell, VT	U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460	September 27, 2007	CERCLA

NAME AND ADDRESS OF GOVERNMENTAL UNIT	CAPTION AND DOCKET NUMBER	STATUS OR DISPOSITION
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. SMC Corp. et al., Civ. Action No. CIV-1-91-234.	Consent Decree dated January 1991.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. SMC Corp. et al., Civ. Action No. CIV-1-91-234.	Consent Decree dated January 1991.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Advanced Resins Systems, Inc., et al., Case No. H 99-4357.	Consent Decree dated 2000.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Advanced Resins Systems, Inc., et al., Case No. H 99-4357.	Consent Decree dated 2000.
New Jersey Department of Environmental Protection, 401 East State Street, Trenton, NJ 08625-2885	BP Exploration & Oil, Inc. v. AGIP USA, Inc. v. A. Margolis & Sons Corp., et al., N.J. Super Ch. Div., Docket No. UNN-C-164-95.	Consent Order of Dismissal with Prejudice dated 1998.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States and Commonwealth of Pennsylvania v. Auburn Technology, Inc., et al., Civ. Action No. 3:CV00-1911 (D. Pa.). In re Butler Mine Tunnel Superfund Site, Docket No. CERC-DEM-2000-01.	Consent Decree dated April 18, 2000.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States and Commonwealth of Pennsylvania v. Auburn Technology, Inc., et al., Civ. Action No. 3:CV00-1911 (D. Pa.). In re Butler Mine Tunnel Superfund Site, Docket No. CERC-DEM-2000-01.	Consent Decree dated April 18, 2000 regarding Butler Tunnel.
Pennsylvania Department of Environmental Conservation and Natural Resources, Rachel Carson State Office Building, 400 Market Street, Harrisburg, PA 17105	United States and Commonwealth of Pennsylvania v. Auburn Technology, Inc., et al., Civ. Action No. 3:CV00-1911 (D. Pa.). In re Butler Mine Tunnel Superfund Site, Docket No. CERC-DEM-2000-01.	Remedial Design/Remedial Action Consent Decree dated April 18, 2000.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States and Commonwealth of Pennsylvania v. Auburn Technology, Inc., et al., Civ. Action No. 3:CV00-1911 (D. Pa.). In re Butler Mine Tunnel Superfund Site, Docket No. CERC-DEM-2000-01.	Remedial Design/Remedial Action Consent Decree dated April 18, 2000.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States and Commonwealth of Pennsylvania v. Auburn Technology, Inc., et al., Civ. Action No. 3:CV00-1911 (D. Pa.). In re Butler Mine Tunnel Superfund Site, Docket No. CERC-DEM-2000-01.	Remedial Design/Remedial Action Consent Decree dated April 18, 2000.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. AAF McQuay, Inc. et al., Civil Action No. 3:95-2023-0.	Consent Decree for Past Costs dated 1995.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. AAF McQuay, Inc. et al., Civil Action No. 3:95-2023-0.	Consent Decree for Past Costs dated 1995.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Advanced Environmental Technology.	Private PRP Settlement Agreement dated August 29, 1990.
New Jersey Department of Environmental Protection, 401 East State Street, Trenton, NJ 08625-2885	United States v. Advanced Environmental Technology.	Settlement Agreement executed October 1998.

NAME AND ADDRESS OF GOVERNMENTAL UNIT	CAPTION AND DOCKET NUMBER	STATUS OR DISPOSITION
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20461	United States v. Advanced Environmental Technology.	Consent Decree dated 1990.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Advanced Environmental Technology.	Consent Decree dated 1990.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Charles Chrin et al., Civ. Action No. 93-CV-4244.	Consent Decree. (Not dated).
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Charles Chrin et al., Civ. Action No. 93-CV-4244.	Consent Decree. (Not dated).
New York State Department of Environmental Conservation, 50 Wolf Road, Albany, New York 12233-1011	In the Matter of the Development and Implementation of a Remedial Investigation, Feasibility Study by Broome County and GAF Corp., Index #T010687.	Order on Consent dated April 13, 1987.
New York State Department of Environmental Conservation, 50 Wolf Road, Albany, New York 12233-1012	In the Matter of the Development and Implementation of a remedial Investigation, Feasibility Study by Broome County and GAF Corp., Index #T010688.	Administrative Order. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Danmark Superfund Site, CERCLA Docket No. 00-12-C.	Agreement for Recovery of Past Response Costs dated March 3, 2000.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Atlas Minerals and Chemicals, Inc., et al., Civ. Action No. 91-5118.	Consent Decree dated January 1993.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Atlas Minerals and Chemicals, Inc., et al., Civ. Action No. 91-5118.	Consent Decree dated January 1993.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Dorney Road Landfill Site, Docket Nos. III-90-45-DC, III-91-26-DC, III-92-33-DC, and III-92-27-DC.	Administrative Order for RD/RA Operable Unit No. 1 of Dorney Road site dated September 28, 1990 and December 27, 1990 modification.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Dorney Road Landfill Site, Docket No. III-92-27-DC.	Administrative Order for RD/RA Operable Unit No. 2 of Dorney Road site dated August 13, 1992.
New Jersey Department of Environmental Protection, 401 East State Street, Trenton, NJ 08625-2885	In the Matter of Gloucester City, ISRA Case No. 90263.	Administrative Order for Site Remediation.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Stephen D. Heleva et al., Civ. Action No. 93-1339 (D. Pa.).	Consent Decree dated May 1996.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20461	United States v. Stephen D. Heleva et al., Civ. Action No. 93-1339 (D. Pa.).	Consent Decree dated May 1996.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20462	United States v. Allied Signal, Inc., et al., Civ. Action No. 3-95-2032-23.	Partial Consent Decree dated August 13, 1996.

NAME AND ADDRESS OF GOVERNMENTAL UNIT	CAPTION AND DOCKET NUMBER	STATUS OR DISPOSITION
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Allied Signal, Inc., et al., Civ. Action No. 3-95-2032-23.	Partial Consent Decree dated August 13, 1996.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. AFF McQuay, Inc. et al., Civ. Action No. 3-95-2032-23.	Partial consent decree dated June 1996.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. AFF McQuay, Inc. et al., Civ. Action No. 3-95-2032-23.	Partial consent decree dated June 1996.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Absolute Fire Protection, Inc., Civ. Action No. 88-2087 (ALJ).	Private Settlement Agreement and Release dated May 20, 1998 in related action captioned Transtech Industries, Inc. v. A & 2 Septic Clean, Civ. Action No. 2-90-2578 (HAA).
New Jersey Department of Environmental Protection, 401 East State Street, Trenton, NJ 08625-2885	In the Matter of GAF Chemicals Corporation Linden.	Administrative Order on Consent dated June 16, 1989.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Lowry Landfill Superfund Site, EPA Docket No. CERCLA VIII-95-05.	Tolling Agreement executed March 2, 2000.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20461	In the Matter of Lowry Landfill Superfund Site, EPA Docket No. CERCLA VIII-95-05.	Administrative Order for Remedial Design/Remedial Action dated December 19, 1994.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20461	In the Matter of Lowry Landfill Superfund Site, EPA Docket No. CERCLA VIII-95-05.	Administrative Order for Remedial Design/Remedial Action dated December 19, 1994.
Missouri Department of Natural Resources, P.O. Box 176, Jefferson City, MO 65102-0176	Riverview Hall Industrial, St. Louis, Missouri.	Environmental remediation Oversight Letter of Agreement dated April 18, 1996.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Air Products and Chemicals, Inc., Civ. Action No. JH-88-364 (D. Md.).	Consent Decree executed September 29, 1987.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Air Products and Chemicals, Inc., Civ. Action No. JH-88-364 (D. Md.).	Consent Decree executed September 29, 1987.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Air Products and Chemicals, Inc., No. 97-CV-0674 (E.D. Pa).	Consent Decree dated May 1998.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Air Products and Chemicals, Inc., No. 97-CV-0674 (E.D. Pa).	Consent Decree dated May 1998.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Air Products and Chemicals, Inc., No. 97-CV-0674 (E.D. Pa).	Consent Decree dated May 1998.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Air Products and Chemicals, Inc., No. 97-CV-0674 (E.D. Pa).	Consent Decree dated May 1998.

NAME AND ADDRESS OF GOVERNMENTAL UNIT	CAPTION AND DOCKET NUMBER	STATUS OR DISPOSITION
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In re Novak Sanitary Landfill Site, Docket No. III-95-52-DC.	Administrative Order for Remedial Design and Remedial Action dated August 31, 1995.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Air Products and Chemicals, Inc., No. 97-CV-0674 (E.D. Pa).	Administrative Order On Consent for Remedial Design. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20461	In the Matter of Novak Sanitary Landfill Site, Air Products and Chemicals, Inc., et al., Docket No. III-95-52-DC.	Administrative Order for Remedial Design and Remedial Action dated June 30, 1995.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Novak Sanitary Landfill Site, Air Products and Chemicals, Inc., et al., Docket No. III-95-52-DC.	Administrative Order by Consent dated December 1988.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20461	In the Matter of Novak Sanitary Landfill Site, Air Products and Chemicals, Inc., et al., Docket No. III-95-52-DC.	Amendment No. 1 to Original Administrative Order for Remedial Design and Remedial Action dated August 31, 1995.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Novak Sanitary Landfill Site, Air Products and Chemicals, Inc., et al., Docket No. III-95-52-DC.	Amendment No. 1 to Administrative Order for Remedial Design and Remedial Action dated August 31, 1995.
Minnesota Pollution Control Agency, 520 Lafayette Road, St. Paul, MN 55155-4194	United States v. (not named), Inc., Civil Action No. 4:92-CV-985.	Settlement of Costs in Oak Grove.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. (not named), Inc., Civil Action No. 4:92-CV-985.	Settlement of Costs in Oak Grove.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. (not named), Inc., Civil Action No. 4:92-CV-985.	Consent Decree for final Remedial Design/Remedial Action. (Not dated.)
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. (not named), Inc., Civil Action No. 4:92-CV-985.	Consent Decree for final Remedial Design/Remedial Action. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. (not named), Inc., Civil Action No. 4:92-CV-985.	Administrative Order for Remedial Design and Remedial Actiondated December 23, 1991.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of The Odessa Drum Site, Ector County, Texas, CERCLA.	Administrative Order on Consent dated May 19, 1994.
Pennsylvania Department of Environmental Conservation and Natural Resources, Rachel Carson State Office Building, 400 Market Street, Harrisburg, PA 17105	Commonwealth of Pennsylvania Department of Environmental Protection v. General Electric Co., et al., Civ. Action No. 96-89 (D. Pa.).	Consent Order and Agreement dated May 1, 1995.
Pennsylvania Office of the Attorney General, 16th Floor, Strawberry Square, Harrisburg, PA 17120	Commonwealth of Pennsylvania Department of Environmental Protection v. General Electric Co., et al., Civ. Action No. 96-89 (D. Pa.).	Consent Order and Agreement dated May 1, 1995.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Omega Chemical Corporation, Order No. 95-15.	Administrative Order dated May 9, 1995.

NAME AND ADDRESS OF GOVERNMENTAL UNIT	CAPTION AND DOCKET NUMBER	STATUS OR DISPOSITION
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Agway, Inc., Civil Action No. 91-CV-0288.	Consent Decree filed December 17, 1990.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Agway, Inc., Civil Action No. 91-CV-0288.	Consent Decree filed December 17, 1990.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In re Agway, Inc., Index No. II CERCLA-60209.	Administrative Order On Consent executed September 1986.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	The Pollution Abatement Services, Inc. Site, Oswego, New York v. Agway, Inc., et al., CERCLA-94-0207.	Administrative Order on Consent issued September 30, 1994.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	The Pollution Abatement Services, Inc. Site, Oswego, New York v. Agway, Inc., et al., CERCLA-94-0207.	Consent Decree dated 1987.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	The Pollution Abatement Services, Inc. Site, Oswego, New York v. Agway, Inc., et al., CERCLA-94-0207.	Consent Decree dated 1987.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	The Pollution Abatement Services, Inc. Site, Oswego, New York v. Agway, Inc., et al., CERCLA-94-0207.	Administrative Order on Consent dated September 27, 1990.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	The Pollution Abatement Services, Inc. Site, Oswego, New York v. Agway, Inc., et al., CERCLA-94-0207.	Consent Order dated October 7, 1991.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	The Pollution Abatement Services, Inc. Site, Oswego, New York v. Agway, Inc., et al., CERCLA-94-0207.	Consent Order dated October 7, 1991.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	The Pollution Abatement Services, Inc. Site, Oswego, New York v. Agway, Inc., et al., CERCLA-94-0207.	Administrative Order on Consent dated August 1, 1994.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	The Pollution Abatement Services, Inc. Site, Oswego, New York v. Agway, Inc., et al., CERCLA-94-0207.	Administrative Order on Consent dated October 8, 1994.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	The Pollution Abatement Services, Inc. Site, Oswego, New York v. Agway, Inc., et al., CERCLA-94-0207.	Consent Decree dated August 10, 1998.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	The Pollution Abatement Services, Inc. Site, Oswego, New York v. Agway, Inc., et al., CERCLA-94-0207.	Consent Decree dated August 10, 1998.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. County of Oswego et al., Civ. Action No. 98-CV-0994, (N. D. N.Y.).	Consent Decree dated October 9, 1998.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. County of Oswego et al., Civ. Action No. 98-CV-0994, (N. D. N.Y.).	Consent Decree dated October 9, 1998.

NAME AND ADDRESS OF GOVERNMENTAL UNIT	CAPTION AND DOCKET NUMBER	STATUS OR DISPOSITION
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Volney Landfill, Index No. CERCLA-104-93-0202.	Administrative Order on Consent for Supplemental Pre-Remedial Design Study re: Operable Unit No. 1. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Volney Landfill, Index No. CERCLA-104-93-0202.	Remedial Design/Remedial Action Consent Decree dated 1998.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	In the Matter of Volney Landfill, Index No. CERCLA-104-93-0202.	Remedial Design/Remedial Action Consent Decree dated 1998.
Florida Department of Environmental Protection, 3900 Commonwealth Boulevard, Tallahassee, Fl 32399	United States v. Akzo Nobel Coatings, Inc. et al., Civ. Action No. 97-1564-CIV-T-269 (formerly 97-1564-CIV-T-99A).	Remedial Design/Remedial Action Consent Decree for Operable Unit Two. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Akzo Nobel Coatings, Inc. et al., Civ. Action No. 97-1564-CIV-T-269 (formerly 97-1564-CIV-T-99A).	Remedial Design/Remedial Action Consent Decree for Operable Unit Two. (Not dated.)
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Akzo Nobel Coatings, Inc. et al., Civ. Action No. 97-1564-CIV-T-269 (formerly 97-1564-CIV-T-99A).	Remedial Design/Remedial Action Consent Decree for Operable Unit Two. (Not dated.)
Florida Department of Environmental Protection, 3900 Commonwealth Boulevard, Tallahassee, Fl 32399	United States v. Bill Currie Ford, Inc., et al.	Remedial Design/Remedial Action Consent Decree for Operable Unit One. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Bill Currie Ford, Inc., et al.	Remedial Design/Remedial Action Consent Decree for Operable Unit One. (Not dated.)
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Bill Currie Ford, Inc., et al.	Remedial Design/Remedial Action Consent Decree for Operable Unit One. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States and State of Rhode Island v. Allied Signal et al.	RD/RA Consent Decree executed October 13, 1995.
Rhode Island Department of Environmental Management, 235 Promenade Street, Providence, RI 02908	United States and State of Rhode Island v. Allied Signal et al.	RD/RA Consent Decree executed October 13, 1995.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States and State of Rhode Island v. Allied Signal et al.	RD/RA Consent Decree executed October 13, 1995.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Ashland Chemical Company, et al., Civ. Action No., 83-0787-P, (D. R.I.).	Consent Decree dated 1987.
Rhode Island Department of Environmental Management, 235 Promenade Street, Providence, RI 02908	United States v. Ashland Chemical Company, et al., Civ. Action No., 83-0787-P, (D. R.I.).	Consent Decree dated 1987.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Ashland Chemical Company, et al., Civ. Action No., 83-0787-P, (D. R.I.).	Consent Decree dated 1987.

NAME AND ADDRESS OF GOVERNMENTAL UNIT	CAPTION AND DOCKET NUMBER	STATUS OR DISPOSITION
New Jersey Department of Environmental Protection, 401 East State Street, Trenton, NJ 08625-2885	Borough of Sayerville, et al. v. Union Carbide Corp., et al., Civ. Action No. 94-5674 (JAG).	Confidential Settlement Agreement dated February 2000.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	Borough of Sayerville, et al. v. Union Carbide Corp., et al., Civ. Action No. 94-5674 (JAG).	Confidential Settlement Agreement dated February 2000.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the matter of Scientific Chemical Processing Site, Index No. II-CERCLA-97-0106.	Administrative Order on Consent dated June 23, 1997.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Air Products and Chemicals, Inc., Index CERCLA-50114.	Order on Consent dated September 30, 1995.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20461	In the Matter of Scientific Chemical Processing Site, Index No II CERCLA-00116.	Administrative Order dated September 28, 1990.
New Jersey Department of Environmental Protection, 401 East State Street, Trenton, NJ 08625-2885	In the Matter of Airco, Inc., et al., Index No. II-CERCLA-50106.	Administrative Order executed April 1, 1985.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Airco, Inc., et al., Index No. II-CERCLA-50106.	Administrative Order executed April 1, 1985.
North Carolina Department of Environment, Health and Natural Resources, 1601 Mail Service Center, Raleigh, NC 27699	In re De Micromis Settlement, Former Seaboard Chemical Corporation Facility.	Administrative Order on Consent regarding De Microminimous Settlers. (Not dated.)
North Carolina Department of Environment, Health and Natural Resources, 1601 Mail Service Center, Raleigh, NC 27700	In re De Micromis Settlement, Former Seaboard Chemical Corporation Facility.	Administrative Order dated July 22, 1997.
North Carolina Department of Environment, Health and Natural Resources, 1601 Mail Service Center, Raleigh, NC 27701	In re De Micromis Settlement, Former Seaboard Chemical Corporation Facility.	Administrative Order on Consent dated January 30, 1996 to remediate Seaboard site.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Seymour Recycling Corp. and Amerace Corporation v. U S Air Force, Civ. Action No. IP-80-457-C, (So. D. Ind.).	Consent Decree dated December 1, 1988.
Indiana Department of Environmental Management, 100 N. Senate, P.O. Box 6015, Indianapolis, IN 46206-6015	United States v. Seymour Recycling Corp. and Amerace Corporation v. U S Air Force, Civ. Action No. IP-80-457-C, (So. D. Ind.).	Consent Decree dated December 1, 1988.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Seymour Recycling Corp. and Amerace Corporation v. U S Air Force, Civ. Action No. IP-80-457-C, (So. D. Ind.).	Consent Decree dated December 1, 1988.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Arco Chemical Co., et al. regarding the Sheridan Disposal Services Site, Docket No. CERCLA VI-01-87.	Administrative Order on Consent dated January 1987.

NAME AND ADDRESS OF GOVERNMENTAL UNIT	CAPTION AND DOCKET NUMBER	STATUS OR DISPOSITION
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v (not named), Inc.	Consent Decree dated 1992.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20461	United States v (not named), Inc.	Consent Decree dated 1992.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v (not named), Inc.	Consent Decree dated 1992.
New Jersey Department of Environmental Protection, 401 East State Street, Trenton, NJ 08625-2885	In the Matter of GAF Corporation.	Administrative Consent Order dated December 19, 1985.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Mathis Brothers/South Marble Top Road Landfill Site, U. S. EPA Docket No. 93-36-C.	Unilateral Administrative Order for Remedial Design and Remedial Action dated August 19, 1993.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Spectron Inc. Site, Docket No. III-96-15-DC.	Administrative Order on Consent to Perform Remediation Work. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Spectron Inc. Site, Docket No. III-96-15-DC.	Consent Agreement by which the EPA will recover past removal costs. (Not dated.)
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	In the Matter of Spectron Inc. Site, Docket No. III-96-15-DC.	Consent Agreement by which the EPA will recover past removal costs. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20461	In the Matter of Spectron Inc. Site, Docket No. III-96-15-DC.	Administrative Order on Consent for Remedial Investigation/Feasibility Study dated 1996.
Florida Department of Environmental Protection, 3900 Commonwealth Boulevard, Tallahassee, Fl 32399	State of Florida Department of Environmental Regulation v. GAF Building Materials Corporation, OGC File Case No. 87-1162.	Consent Order dated July 1, 1998.
Pennsylvania Office of the Attorney General, 16th Floor, Strawberry Square, Harrisburg, PA 17120	State of Florida Department of Environmental Regulation v. GAF Building Materials Corporation, OGC File Case No. 87-1162.	Consent Order dated July 1, 1998.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Alpha Metals, Inc. ,et al., Civ. Action No. G-96-277 (consolidated with Civ., Action No. G-96-247 and G-96-272) (D. Tex.).	Partial Consent Decree dated November 29, 1999.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Alpha Metals, Inc., et al., Civ. Action No. G-96-277 (consolidated with Civ., Action No. G-96-247 and G-96-272) (D. Tex.).	Partial Consent Decree dated November 29, 1999.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Alpha Metals, Inc., et al., Civ. Action No. G-96-277 (consolidated with Civ., Action No. G-96-247 and G-96-272) (D. Tex.).	Partial Consent Decree dated November 29, 1999.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Alpha Metals, Inc., et al., Civ. Action No. G-96-277 (consolidated with Civ., Action No. G-96-247 and G-96-272) (D. Tex.).	Consent Decree. (Not dated.)

NAME AND ADDRESS OF GOVERNMENTAL UNIT	CAPTION AND DOCKET NUMBER	STATUS OR DISPOSITION
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Alpha Metals, Inc., et al., Civ. Action No. G-96-277 (consolidated with Civ., Action No. G-96-247 and G-96-272) (D. Tex.).	Consent Decree. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Alpha Metals, Inc., et al., Civ. Action No. G-96-277 (consolidated with Civ., Action No. G-96-247 and G-96-272) (D. Tex.).	Consent Decree. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Alpha Metals, Inc., et al., Civ. Action No. G-96-277 (consolidated with Civ., Action No. G-96-247 and G-96-272) (D. Tex.).	Partial Consent Decree dated November 1999.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Alpha Metals, Inc., et al., Civ. Action No. G-96-277 (consolidated with Civ., Action No. G-96-247 and G-96-272) (D. Tex.).	Partial Consent Decree dated November 1999.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	United States v. Agway et al., Index # II-CERCLA-96-0207.	Consent Decree. (Not dated.)
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Agway et al., Index # II-CERCLA-96-0207.	Consent Decree. (Not dated.)
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Tri-Cities Barrel Co., Inc. Superfund Site, Index # II-CERCLA-96-0207.	Administrative Order on Consent for Removal Action dated September 30, 1991.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Tri-Cities Barrel Co., Inc. Superfund Site, Index # II-CERCLA-96-0207.	Administrative Order on Consent for Remedial Investigation/Feasibility Study dated April 1992.
State of New York (for New York State Department of Transportation), Division of Law, The Capitol, 2nd Floor, Albany, NY 12224	United States v. Agway et al., Index # II-CERCLA-96-0207.	Consent Decree dated October 2000. GAF is not a party due to bankruptcy.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Agway et al., Index # II-CERCLA-96-0207.	Consent Decree dated October 2000. GAF is not a party due to bankruptcy.
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	United States v. Agway et al., Index # II-CERCLA-96-0207.	Consent Decree dated October 2000. GAF is not a party due to bankruptcy.
New Jersey Department of Environmental Protection, 401 East State Street, Trenton, NJ 08625-2885	In the Matter of The University Avenue Site and GAF Building Materials Corp.	Administrative Consent Order dated June, 1990.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Vanguard Vinyl Siding Inc., Gloucester City, Camden County, New Jersey, Index No. II CERCLA-96-0107.	Administrative Order on Consent executed June 23, 1997.
United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460	In the Matter of Vanguard Vinyl Siding Inc., Gloucester City, Camden County, New Jersey, Index No. II CERCLA-96-0107.	Administrative Order on Consent for Removal Action dated January 20, 1997.
State of Oregon, Department of Environmental Quality, 811 SW 6th Avenue, Portland, OR 97204	In the Matter of GAF Corporation and Mattel Inc., DEQ No. WMCSR-NWR-98-17.	Final Order on Consent dated November, 1998.

NAME AND ADDRESS OF GOVERNMENTAL UNIT	CAPTION AND DOCKET NUMBER	STATUS OR DISPOSITION
United States Department of Justice, Environmental & Natural Resources Division, Environmental Enforcement Section, PO Box 7611, Ben Franklin Station, Washington, D.C. 20044-7611	United States v. City and Couny of Denver et al., Civ. No. 02-N-1341 (MJW)	Covenant Beneficiary Election Form, dated September 25, 2005
State of Oregon, Department of Environmental Quality, 811 SW 6th Avenue, Portland, OR 97204	State of Oregon et al. v. G-I Holdings, Inc. et al. (Case No. unknown)	Consent Decree, December 27, 2002
U.S. Department of Justice, 950 Pennsylvania Avenue, NW, Washington, DC 20530-0001	In the Matter of Novak Sanitary Landfill Site, Air Products and Chemicals, Inc., et al., Docket No. III-89-10-DC.	Settlement with Novak RI/FS Non-Participants, June 6, 2006
New Jersey Department of Environmental Protection, 401 East State Street, Trenton, NJ 08625-2885	I/M/O Former GAF Corporation Main Plant Site, 1 Main Street, South Bound Brook, Somerset County, New Jersey, Block 57, Lots 1.01, 1.02 and 12 (historically Lot 1) on the Tax Map of the Borough of South Bound Brook	Settlement Agreement and Remediation Agreement, June 28, 2005

Exhibit K

REMEDIAL INVESTIGATION REPORT
ISP-ENVIRONMENTAL SERVICES INC. (ISP-ESI)*
GAF CHEMICALS CORPORATION SITE
LINDEN, NEW JERSEY

Prepared for:

ISP-Environmental Services Inc.
1361 Alps Road
Wayne, New Jersey 07470-3688

Prepared by:

ECKENFELDER INC.
1200 MacArthur Boulevard
Mahwah, New Jersey 07430

227 French Landing Drive
Nashville, Tennessee 37228

September 20, 1991

6230

* - On May 8, 1991, GAF Chemicals Corporation reorganized. As a result, the Linden facility (the "Site") was transferred to ISP Environmental Services Inc. ("ISP-ESI"), a newly created, indirect subsidiary of GAF Chemicals Corporation. The reorganization did not result in any change to the physical plant, activities, or operations at the Site

GAF CHEMICALS CORPORATION
1361 Alps Road Wayne NJ 07470-3688
201 628 3000

A Subsidiary of
GAF CORPORATION

September 20, 1991

Mr. Joseph Freudenberg
Division of Hazardous Waste Management
Bureau of Federal Case Management
401 East State Street
CN 028
Trenton, New Jersey 08625-0028

RE: Remedial Investigation Report
ISP - Environmental Services Inc. (ISP-ESI)
GAF Chemicals Corporation Site
Linden, N.J.

Dear Mr. Freudenberg:

Please find enclosed three (3) copies of the Remedial Investigation Report for the GAF Chemicals Corporation/ISP-ESI site, Linden, New Jersey for review by the department. This document has been prepared pursuant with the Administrative Consent Order dated June 16, 1989 and the comments received in your letter dated August 22, 1991. Also please find enclosed a letter outlining each specific addition or deletion to the document to help facilitate the review.

If you have any questions or comments please contact us.

Very truly yours,

Neil A. Kaye

Neil A. Kaye
Manager
Waste Abatement

NAK/bhk
Enclosures

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LIST OF DRAWINGS (Continued)

LIST OF DRAWINGS (Continued)

EXECUTIVE SUMMARY

This report presents the results of the Remedial Investigation conducted at the ISP-Environmental Services Inc./GAF Chemicals Corporation plant located in Linden, New Jersey, hereinafter referred to as the "Site". The Site property constitutes approximately 147 acres and is located in a heavily industrialized area between the Arthur Kill and the New Jersey Turnpike.

Many different chemical products were manufactured at the Site under various ownerships from 1919 until the plant's closure in 1991. These products primarily consisted of dyestuffs and surfactants but also have included caustic chlorine, ethylene oxide, herbicides, tetrahydrofuran (THF) and others.

A Remedial Investigation (RI) has been conducted in accordance with an Administrative Consent Order from the New Jersey Department of Environmental Protection (NJDEP), dated June 16, 1989. The RI consisted of a detailed multi-media investigation of the entire Site that addressed soils, waste materials, groundwater, surface water and sediments, and ambient air quality. The RI has also utilized many of the hydrogeologic data that have been collected in conjunction with ISP-Environmental Services, Inc.'s (formerly GAF Chemicals Corporation) application for Site designation as a commercial hazardous waste incinerator.

The following work was conducted during the RI:

- Collection and laboratory analysis of 301 soil/waste samples from 101 borings and 62 surficial sample locations.
- The installation of 27 new monitoring wells. Combined with the existing monitoring wells, a network of 30 shallow and 12 bedrock "GAF-" prefix wells now exist at the Site.
- The collection and analysis of a round of groundwater quality samples from each of the 42 monitoring wells.

- Miscellaneous hydrogeologic tasks including the installation of shallow wellpoints, hydraulic conductivity testing, water level measurements and a land survey.

- The collection of eight surficial soil and ditch sediment samples for analysis for 2,3,7,8-TCDD (Dioxin).

- The collection and analysis of 12 sediment samples and three water samples from the open Site ditch system.

- The collection and analysis of three sediment samples from Piles Creek.

- The collection and analysis of 12 sediment samples from the Arthur Kill.

- The determination of the levels of total volatile organic compounds in the ambient air with the use of a field operated flame ionization detector.

The data from this investigation are presented in detail in the Draft Remedial Investigation Report. A Risk Assessment will be prepared and submitted to the Department by June 15, 1991. The Risk Assessment will provide a perspective of the Site's existing and potential future impact on human health and the environment.

By way of summary, the following conclusions can be drawn regarding the hydrogeologic and environmental conditions of the Site:

- The Site is covered by a nearly continuous mantle of fill that has been used to reclaim the Site from tidal marsh that formerly existed in the region. The fill consists of a heterogeneous mixture of soil and industrial materials including industrial waste.

- The fill is underlain by a continuous series of unconsolidated and consolidated geologic materials. The unconsolidated materials include tidal marsh deposits, glacial till and decomposed bedrock (residual soil). These materials are underlain by the shales and siltstones of the Passaic formation.

- Two distinct groundwater bearing zones have been investigated:

  - An upper water bearing zone within the fill and the peat subunit of the tidal marsh deposits.

  - An aquifer contained within the upper portion of the Passaic formation bedrock. The bedrock aquifer is confined by an aquitard comprised of the silt and clay subunit of the tidal marsh deposits and the glacial till.

- Groundwater within the upper water-bearing zone flows primarily in a horizontal direction towards and discharges to both the on site ditch system and the surface water bodies located on and around the Site including Piles Creek and the Arthur Kill.

- Groundwater from a large central area of the Site, in the upper water bearing zone, is captured by the Site ditch system from which it is conveyed to the Site's wastewater treatment plant.

- The bedrock aquifer is separated from the upper water bearing zone by a laterally continuous aquitard. Groundwater in the bedrock aquifer flows from west to east to the off site regional discharge area represented by the Arthur Kill.

- There are no water supply wells located within a two mile radius of the Site.

- A number of analytes were detected at relatively high concentrations in the fill. The highest levels were observed in the "Intermediate" depth samples, that is, samples that were collected from a depth of four to sixteen feet below the ground surface. The most prominent constituents included a number of base/neutral extractable organics, mercury and chromium. These constituents are widely distributed across the entire Site with the highest levels observed in the "Old Landfill", beneath a number of former production buildings and in the peninsula area west of Building No. 48.

- Of the twenty five soil/waste samples analyzed for hazardous waste analyses, only three can be classified as characteristic hazardous wastes.

- Many of the natural soil samples collected at a depth of three to five feet below the fill contain most of the same constituents that were observed in the overlying fill. However, these compounds were generally detected at lower concentrations.

- Groundwater entering the site, as observed in upgradient wells, does not contain any of the organic constituents that were observed in many of the downgradient wells located on the Site. Furthermore, levels of metals in these background wells are either non-detectable or at concentrations that are much lower than the downgradient wells.

- Groundwater quality in the upper water bearing zone has been impacted by the Site. The distribution of the chemical constituents in the groundwater is highly heterogeneous, and is likely due to the variable levels of the constituents contained in the fill and due to the complex groundwater flow pattern in the upper water bearing zone. The primary constituents include a number of volatile and semi-volatile organic compounds, mercury, chromium and arsenic.

- Groundwater contained in the bedrock aquifer has also been impacted to a significant degree. Most of the same compounds observed in the upper water bearing zone have also been detected in many of the bedrock wells, including a number of volatile and semi-volatile organic compounds, mercury, chromium and arsenic. Calculated groundwater flow rates in the bedrock aquifer would suggest that constituents originating from the Site have reached the Arthur Kill.

- Groundwater in the bedrock aquifer is naturally saline, and therefore non-potable, due to its proximity to the Arthur Kill and its tributaries. This salinity is demonstrated by the similarity of the ratio of the inorganic major ions in the groundwater as compared to that of seawater.

- None of the soil or sediment samples that were tested specifically for 2,3,7,8-TCDD contained detectable concentrations.

- The Site ditch sediments contain detectable concentrations of a number of volatile and semi-volatile organic compounds, mercury, chromium and arsenic.

- Water contained in the Site ditches contains detectable concentrations of a number of volatile and semi-volatile organic compounds, and metals including mercury, lead, chromium and arsenic.

- The sediment samples from Piles Creek do not contain detectable levels of either volatile organics or acid extractable organic compounds. However, concentrations of base/neutral extractable organics and a number of metals including mercury were observed.

- The Arthur Kill sediment samples were not observed to contain either volatile organics or acid extractable organic compounds. However detectable concentrations of base/neutral extractable organics and metals were observed both in the background samples and in the samples collected adjacent to GAF's existing and historic outfalls.

- The ambient air testing did not reveal the presence of volatile organic compounds in the air at levels that are significantly above background.

1.0 INTRODUCTION

This document presents the results of the Remedial Investigation (RI) that has been conducted at the ISP Environmental Services, Inc./GAF Chemicals Corporation plant located in Linden, New Jersey, hereinafter referred to as the "Site". Chemical products have been manufactured at the Site under various ownerships from 1919 until the plant's closure on April 1, 1991. As such, the Site has a complex history both with regard to land use and to the materials that have been handled at the various facilities that have been located there.

The RI has been conducted on behalf of ISP Environmental Services, Inc. (ISP-ESI) (formerly GAF Chemicals Corporation) in accordance with an Administrative Consent Order (ACO) from the New Jersey Department of Environmental Protection (NJDEP) dated June 16, 1989. Prior to the initiation of the RI, a detailed Work Plan (WP) was prepared, dated December 21, 1989, which described the specific methods and procedures that were utilized. The WP was conditionally approved by the NJDEP in a letter dated February 14, 1990. The conditions consisted primarily of several minor additions to the field sampling requirements which were subsequently described in an addendum to the WP, dated April 20, 1990.

The RI consisted of a detailed, multi-media investigation of the entire Site. This investigation addressed soils, waste materials, groundwater, surface water and sediments, and ambient air quality. Furthermore, the RI report has utilized much of the data that have been collected at the Site for other purposes. Most of these are hydrogeologic data that have been collected in conjunction with ISP-ESI's (formerly GAF) application for Site designation as a commercial hazardous waste incinerator.

The RI report is contained within six volumes. Volume I contains the RI report text. A set of maps is presented in Volume II as a bound set of "D" size (24" x 36") drawings. A Risk Assessment on Human Health and the Environment based upon the RI data is presented as Appendix A in Volumes III and IV. The other appendices are found in Volumes V and VI. Finally, the

USEPA Contract Lab Program (CLP) Deliverable Package for the laboratory analytical data has been bound as series of 444 volumes and transmitted to NJDEP directly from ISP-ESI.

After the completion of the remedial investigation report and receipt of final status by the NJDEP, a feasibility study will be prepared to address the remediation of the chemical constituents detected at the site.

2.0 SITE CHARACTERISTICS

2.1 SITE OPERATION AND DESCRIPTION

In this section, the location, ownership history and a description of the Site's operation, disposal practices, and hazardous materials use are presented.

2.1.1 Site Location

The Site is located along the Arthur Kill in the Grasselli Point section of the City of Linden, New Jersey, as shown on Figure 2-1. The Site's property currently constitutes approximately 147 acres, as depicted on Drawing No. 6070-001.

2.1.2 Ownership

Industrial operations in the Grasselli Point area of Linden began in 1885 as the Grasselli Chemical Company. However, the portion of the former Grasselli Chemical Co. property now owned by GAF was not utilized for chemical production until approximately 1919. In 1924, the company became the Grasselli Dyestuff Company of I.G. Farben which in 1929 became the General Aniline Works of the American I.G. Chemical Corporation, owned by I.G. Farbenindustrie A.G., a German company. The U.S. company's name was changed in 1939 to General Aniline and Film Corporation. In 1942, 98% of the company stock was seized by the United States Justice Department as a war asset, and the facility was operated by the U.S. Government as Alien Property Custodian until 1965, at which time the U.S. Government sold the stock in a public offering. On April 24, 1968, General Aniline and Film Corporation changed its name to GAF Corporation. In 1986, GAF Chemicals Corporation was incorporated, and all of the assets, including the site of the former Chemicals Division of GAF Corporation, were transferred to GAF Chemicals Corporation, a wholly-owned subsidiary of GAF Corporation. In 1989, GAF Corporation became a

SOURCE: ARTHUR KILL, N.J. - N.Y.
(1966) REVISED 1980
ELIZABETH, N.J. - N.Y.
(1967) REVISED 1980
N.J. 7.5' QUADRANGLE

MAP LOCATION

2000 0 2000
SCALE FEET

FIGURE 2-1

SITE
LOCATION MAP

GAF CHEMICALS CORPORATION
LINDEN, N.J.

ECKENFELDER INC.
Nashville, Tennessee
Mahwah, New Jersey

privately-owned company but retained essentially the same corporate structure as before, including *GAF Chemicals Corporation as a wholly-owned subsidiary* and owner of the Site. A tabular presentation of this history is presented on Table 2-1.

2.1.3 Operational History

Many different industrial products were produced from 1919 to 1991 on the Site. These products primarily consisted of dyestuffs and surfactants but have also included caustic chlorine, ethylene oxide, herbicides, tetrahydrofuran (THF) and others. The production products and their dates of production are listed on Table 2-2. Also included on this table are the primary raw materials used in each process and the wastes associated with each product.

2.1.4 Disposal Practices

Industrial activities at the present Site occured for at least 70 years until the plant's recent closing. The entire Site has been constructed on man-emplaced fill that has been used to reclaim the tidal marshlands that formerly existed in the entire area around the Site. Historical expansion of the plant has been accomplished through the filling of adjacent marshlands with both industrial fill and clean soil prior to constructing additional plant buildings. In addition, a system of ditches has been used for the conveyance and disposal of wastewater and stormwater.

Two landfill areas at the Site are well documented. These areas include the "Old Landfill" located in the south central portion of the Site and the "Drum Landfill" located west of Building 120. The Old Landfill was used from the mid-1950's until 1970. The Drum Landfill was registered with the NJDEP and was operated from 1970 to 1973. These landfill areas are identified on Drawing No. 6070-002.

A history of the fill placement in the previously described landfills and other areas has been developed from a detailed examination of numerous aerial photographs as presented in the Work Plan. Areas of apparent industrial fill placement were identified through the examination of aerial photographs.

TABLE 2-1

LINDEN PLANT OWNERSHIP

Company	Year
Grasselli Chemical	1885
Grasselli Chemical Dyestuff Division	1919
Grasselli Dyestuff Company of I.G. Farben	1924
American I.G. Chemical Corporation - General Aniline Works	1929
General Aniline & Film Corporation (name change)	1939
U.S. Government - Alien Property Custodian	1942
General Aniline & Film Corporation - became Public Company	1965
GAF Corporation (name change)	1968
GAF Chemicals Corporation (wholly-owned subsidiary of GAF Corporation	1986
GAF Chemicals Corporation - (GAF Corporation became private company)	1989

TABLE 2-2

HISTORICAL USE OF RAW MATERIALS, PRODUCTS AND WASTES

1919-1974 Dyestuffs

Raw Materials:	Reactants including Benzene and Toluene Benzoyl Chloride Inorganic Acids and Bases Sulfuric Acid Anthraquinone Ammonia Mercury (catalyst) Arsenious Acid (catalyst) Sodium Dichromate Copper Salts and Copper Metal Solvents, such as: Benzene, Toluene, Isopropyl Alcohol, Methanol, Ethanol
Wastes:	Acid gas emissions to atmosphere during the early years, then through water scrubbers. Wastewater neutralized with lime was discharged to the ditch system.

1935 to 1991 - Igepons (Surfactants)

Raw Materials:	Fatty Acids Phosphorous Trichloride
Wastes:	HCl Solution, Weak Sulfuric Acid Solution, Phosphoric Acid Solution - all drained to the ditch system and neutralized. Acid gas emissions to atmosphere during the early years of manufacture, then through water scrubbers. Scrubber discharged to the ditch system and treated.

1940 to 1991 - Igepals (Surfactants)

Raw Materials:	Diamylphenol Di-isobutylphenol Sodium Hydroxide Ethylene Oxide Nonene Phenol	Boron Trifloride Activated Clay Amberlyst Resin Recovered Phenol
Wastes:	Waste clays disposed of on site; still bottoms disposed of on site until 1973, when they were sent to an off-site disposer. Waste nonane burned in boilers.	

TABLE 2-2 (continued)

HISTORICAL USE OF RAW MATERIALS, PRODUCTS AND WASTES

1941 to late 1940s - Carbonyl Iron Powders

Raw Materials:	Hydrogen	Iron Powder
	Iron Sponge	Anhydrous Ammonia
	Carbon Dioxide	Calcium Silicate
	Coke	
Wastes:	Waste iron cake disposed of on site.	

1945 to 1957 - Reppe Chemistry Pilot Plant (Vinyl Pyrrolidone, Poly Vinyl Pyrrolidone)

Raw Materials:	Formaldehyde	Calcium Carbide
	Acetylene	Water
	Methylamine	
	Ammonia	
Wastes:	Waste waters neutralized with lime.	

1955 to 1971 - Caustic Chlorine

Raw Materials:	Sodium Chloride	Recovered Mercury
	Water	
	Mercury	
Wastes:	Residual mercury-containing sludges were discharged to ditch system after recovery process.	

1957 to 1971 - Ethylene Oxide

Raw Materials:	Ethylene
	Air
	Platinum and Silver Catalyst
Wastes:	Spent catalyst recovered and recycled.
	Glycols sold as antifreeze.

TABLE 2-2 (continued)

HISTORICAL USE OF RAW MATERIALS, PRODUCTS AND WASTES

<u>1958 to 1991 - Phosphate Esters (Surfactants)</u>

Raw Materials: Phosphorous Pentoxide
Phosphorous Oxychloride
Non-ionic Surfactants

Wastes: Acid gases to atmosphere or scrubber. Scrubber discharges to ditch system and is treated.

<u>1962 to 1979 - Agricultural Herbicides, Ammiben Amino Type Compounds</u>

Raw Materials: Iron Catalyst
Sponge Iron
Benzoyl Chloride
Caustic
Ammonia
Sulfuric Acid
Nitric Acid
Benzyl Trifloride
2,4,5-trichlorophenol

Wastes: Acid gases to recovery, residuals to scrubbers.
Scrubber discharges to ditch system.
Iron wastes and still bottoms disposed of on site until 1973.

<u>1963 to 1991 - Low Foamers (Surfactants)</u>

Raw Materials: Non-ionic Surfactants
Thionyl Chloride
Ethylene Oxide
Propylene Oxide
Alcohols
Allylphatic Compounds

Wastes: Acid gases to scrubbers.
Scrubber discharges to ditch system.

<u>1964 to 1986 - Polyclar (Polyvinyl Pyrrilodone Polymer)</u>

Raw Materials: Potassium Hydroxide
Water
Vinyl Pyrrilodone

Wastes: Caustic wastewater to ditch system.

TABLE 2-2 (continued)

HISTORICAL USE OF RAW MATERIALS, PRODUCTS AND WASTES

<u>1965 to 1969 - Gantrez Half Esters</u>

Raw Materials:	Maleic Anhydride Benzene Butanol Ethanol	Isopropyl Alcohol
Wastes:	Solvent emissions to air and solvents to waste water ditch system	

<u>1966 to 1988 - Gantrez</u>

Raw Materials:	Same as Gantrez Half Esters Toluene
Wastes:	Solvents to atmosphere or scrubbers. Scrubber discharges to ditch system.

<u>1970 to 1991 - Gafquat 755</u>

Raw Materials:	Vinyl Pyrrolidone Dimethyl Amino Ethyl Methacrylate Alcohols Acrylic Acid Ethyl Ester
Wastes:	Ammonia emissions to scrubbers. Scrubbers discharge to ditch system.

<u>1975 to 1991 - Propoxylations (Surfactants)</u>

Raw Materials:	See Low Foamers
Wastes:	See Low Foamers

<u>1976 to 1991 - Tetrahydrofuran</u>

Raw Materials:	Butanediol Solution Sulfuric Acid
Wastes:	Still bottoms shipped off site.

Other industrial disposal practices, such as the use of industrial impoundments, have also been located through the use of aerial photographs and a search of historical site plans. These areas of fill emplacement and the locations of industrial impoundments that have been defined are depicted on a site plan, Drawing No. 6070-002.

The Site contains a ditch system for the purpose of conveying cooling water, wastewater, and surface water drainage to the wastewater treatment plant, as depicted on Drawing No. 6070-003. Prior to the start up of the wastewater treatment plant (WWTP) in 1977, the ditch system discharged to the Arthur Kill through either of two ditches, as shown on Drawing No. 6070-003. These ditch discharges were treated for several decades prior to construction of the current WWTP, employing equalization, skimming and lime neutralization. The northern of the two ditches was used for the longest period of time, up to approximately 1971. The southern ditch, South Branch Creek, was used for a shorter time, from 1971 to 1977, when the new WWTP was placed into operation.

In addition to the discharges to the Arthur Kill, manufacturing areas in the north-central and the western portions of the Site's system formerly discharged to Piles Creek at a point west of Building No. 120. However, this discharge was cut off by the construction of a dam in 1966, as depicted on Drawing No. 6070-003.

2.1.5 Hazardous Material Use

Hazardous materials, including waste materials, were contained or used in a number of locations around the Site. These materials have been handled in various tanks, industrial storage areas, surface impoundments, ditches, landfills, and within the numerous production and warehousing buildings that currently exist or which existed previously at the Site. Landfills and surface impoundments were described previously in Section 2.14. Other areas are described below.

Areas of the Site that currently or historically contained above ground storage tanks that are not located within buildings have been located from a detailed review of historical site plans and the aerial photographs as presented in the Work Plan. These areas are depicted on Drawing No. 6070-004 with an "ST." prefix. Also shown on this plan are the locations of other types of industrial storage areas (demoted with an "S." prefix), such as those used for the storage of drums.

Only two below ground storage tanks are known to have ever existed at the Site. Each of the underground tanks contained gasoline. The underground tanks are depicted with a "UST." prefix on Drawing No. 6070-004.

Underground tank UST.1 contained gasoline. The dimensions of the tank and the date of installation are unknown. The tank was removed in 1978.

Underground tank UST.2 had a capacity of 2000 gallons. The top of the tank was approximately three feet below grade, while the bottom of the tank extended to a depth of approximately 8-1/2 feet. The entire tank was submerged below the groundwater table. The installation date of the tank is not known.

Tank UST.2 was removed on December 12, 1989 by an underground tank contractor. A visual inspection of the tank indicated that it was completely sound. However, there was some indication of oil staining in the adjacent surficial soils likely as a result of minor spillage from the adjacent aboveground tank that contains diesel fuel (ST.40). Nine soil samples were collected from various depths in the tank excavation in an effort to confirm the origin of the oil staining.

Each of the industrial processes, with the exception of the THF production process, was housed within the buildings on the Site. In addition to the process equipment, many tanks are and were located within buildings. All of these buildings had direct discharges to the Site's ditch system.

All of the buildings known to have existed at the Site are listed on Table 2-3, and are depicted on Drawing No. 6070-005. The buildings that currently or historically contained significant quantities of hazardous

TABLE 2-3

SUMMARY OF ALL SITE BUILDINGS

Building No.	Time Period	Activities
1	1929 ± 1952	Production
3	1929 ± 1976	Cooperage - Warehouse
5	1921 ± 1978	Carpenter Shop
6	1920 ±	Mason Shop
7	1920 ±	Rigger Shop
8	1921 ± 1976	Warehouse
9	1920 ± 1976	Paint Shop - Lead Shop
13	1940*	Power House
18	1929 ± 1976	Firehouse - Safety Equipment
20	Date Unknown	Pipe Shop
22	Date Unknown	Production
23	Date Unknown	Production
24	Date Unknown	Production
25	Date Unknown	Production
26	Date Unknown	Production
27	Date Unknown	Production
28	Date Unknown	Production
29	1929*	Garage
31	1915 ± 1978	Laboratory and Offices
33		Laboratory Store Room
34	1941 ±	Naphthaline Storage
35	1921 ± 1984	Offices, later Warehouse - Pipe Shop
36	1921*	Production
40		Unknown
41A	1942 ±	Unknown
41B	1965*	THF Still
42	1942 ±	Soda Ash Storage
43	1944 ±	Metal Storage
44	1925 ± 1976	Water Meters
45	*	Chill Brine House - Refrigeration Equipment
46	1926 1986*	Production
47	1927*	Engineering Department and Maintenance Shops
48	1934*	Warehouse/Laboratory
49	1934 ± 1976	Production
50	1927 ± 1982	Production
51	1929 ± 1982	Laboratory and Offices
52	1927*	Production
53	1937*	Production (1937-1974) Waste Storage (1974-1986)
56		Oil House

TABLE 2-3 (continued)

SUMMARY OF ALL SITE BUILDINGS

Building No.	Time Period	Activities
63	*	Oil Pumping Station
66	*	Coal Silos
100	1939/40*	Administration Building
101	1929*	Showers and Lockers
110	*	Cooling Water Pumps
120	1956*	Warehouse
200/201	1941 ±	Ammonia Storage and Filling Station
200	1940*	Production
201	1940 ± 1976	Storage
202	1947 ± 1976	Acetylene Generation
203	1941 ± 1976	Offices and Laboratory
204	1946*	Pilot Plant/Semi-Works Production
205	1916 ± 1929	Storage
207	1970*	Pilot Plant/Engineering Offices Laboratory and later Silver Recovery
300	*	Ethylene Oxide Area/Administration
301		Service Building
302		Utilities
303		Reaction Building
304		Compressor Control
305		Distillation Building
306	*	Refrigeration Building
308		Substation
309		Storage
350	*	Machinery Building
400	*	Electrical Control
402	*	Pump Station
410	*	Filter Press & Control

Note:

*Building still in existence, either wholly or in part materials, either for production or storage, are highlighted on Drawing No. 6070-005 and are described on Table 2-4. Also presented on Table 2-4 are details regarding the processes and materials contained within the listed buildings.

PCBs were never used in the industrial processes either as a heat transfer fluid or for other purposes. However, there are 18 electrical transformers that presently or formerly contained PCBs. A contractor has implemented a PCB abatement program in which all transformers have been retrofilled. The contractor is also responsible for the removal and disposal of the PCB-containing transformers oils. Currently, only 3 transformers contain PCBs at levels greater than 50 ppm, each of which are housed within a building. Fifteen other transformers, all located outdoors, have been retrofilled such that they now all have PCB levels less than 50 ppm. The locations of these transformers are depicted on Drawing No. 6070-004; the details are presented on Table 2-5.

2.1.6 Underground Utilities

The underground utilities which exist at the Site consist of fresh water supply, salt water supply, and gas lines. Drawing No. 6070-006 depicts the location of these utility lines. Drawing 6070-006A displays the location of the fenceline in relation to the property line.

2.2 PREVIOUS INVESTIGATIONS

A number of environmental investigations have previously been conducted at the Site. These are listed on Table 2-6.

The environmental work has been conducted for a number of different purposes. A great deal of hydrogeologic work has been conducted relating to ISP-ESI's application for Site Designation for a commercial hazardous waste incinerator.

TABLE 2-4

BUILDINGS CONTAINING SIGNIFICANT HAZARDOUS MATERIALS

BUILDING 3AB:	
Activity:	Drums and barrels used for intermediate and semi-finished dyestuffs and pigments were washed in this building for reuse. Residue from products manufactured in Buildings 46, 49, 50 and 52 were rinsed from these containers.
BUILDING 13:	
Activity:	Powerhouse. This unit has burned various production byproducts including nonene, nonane, di-nonyl phenol bottoms, ethanol, and ortho nitro toluene as a supplement to the No. 6 fuel oil.
BUILDING 24:	
Activity:	Produced sulfur colors and nitrobenzene, dinitrobenzene, nitrotoluene and dinitrotoluene.
Raw Materials:	Inorganic acids and bases, non-metallic elements and several hydrocarbons.
BUILDING 36:	
Activity:	Produced sulfur colors, bacteriacide/fungicide, beta oxy naphthoic acid and numerous surface active agents.
Raw Materials:	Inorganic acids including sulfuric and nitric, and inorganic bases including caustic chloride. Various organics including ethylene oxide, nonene, phenol, alkyl phenol, di-isobutylene, sodium oxethane, disobutyl phenol, chlorobenzene, 2,4,5 trichlorophenol, amines, various alcohols, non-metallic elements, and several acid chlorides.
Byproducts:	Organic solvents, caustic solutions, poly alkyl phenols, fatty acid residues, and nonyl phenol.
BUILDING 46:	
Activity:	Produced dye intermediates
Raw Materials:	Inorganic acids and bases, various metallic catalysts, and numerous other organic salts purchased or produced in 49 Building, and numerous hydrocarbon solvents.
Byproducts:	Sodium sulfide, dinitrobenzene isomers, iron oxide sludge, dichlorobenzoyl chloride still bottoms, arsenic acid, and ammonia.

TABLE 2-4 (continued)

BUILDINGS CONTAINING SIGNIFICANT HAZARDOUS MATERIALS

BUILDING 48, Dept. 600:

Activity: Produced color formers for the former Binghamton photo products plant.

Raw Materials: Inorganic acids including chlorosulfonic acid, inorganic bases, organic solvents, including methyl hexanone, xylene, THF, toluene, naphthalene, nitrobenzene, benzene, heptane, chloro-nitrobenzene, acetone, pyridine and ethylene dichloride, as well as mercury, diethylamine, and anhydrous ammonia.

Byproducts: Acetic acid, organic solvents and mercury compounds.

BUILDING 49:

Activity: Produced dye intermediates.

Raw Materials: Inorganic acids and bases, various metallic catalysts including mercury, numerous other salts purchased or manufactured in 46 Building, and various organics, including chlorobenzene, nitrobenzene, and anthraquinone.

Byproducts: Organic solvents, dilute sulfuric acid, benzoic acid, arsenic medicuric sulfate, metallic mercury, polychlorobenzoyl chlorides, polychlornitro benzenes, iron sludges, and lime cakes.

BUILDINGS 50, 52, AND 53:

Activity: Produced dyestuffs and pigments. Building 50 was used primarily for simple acid pasting; Building 52 was used for dyestuff and pigment production using intermediates from 46 and 49 Buildings and for pigment production using urea and phthalic anhydride. Building 53 was used for physical conditioning of products from Buildings 50 and 52.

Raw Materials: Dye intermediates produced in Buildings 46 and 49; inorganic acids including chlorosulfonic and sulfonic, inorganic bases, various chlorinated solvents including nitrobenzene, dichlorobenzene, trichlorobenzene, naphthalene, metallic and non-metallic elements, including sulfuryl chloride, cuprous chloride, and aluminum chloride.

Byproducts: Ammonia, organic solvents, sodium sulfites, m-amino benzene sulfonate, sodium acetate, ethylene glycol iron cake, and tars.

TABLE 2-4 (continued)

BUILDINGS CONTAINING SIGNIFICANT HAZARDOUS MATERIALS

BUILDING 120:

Activities: Surfactant materials of all kinds, i.e., Igepals, non-ionic surfactants, Alipals, phosphate esters, and low foamers are drummed and stored in this building.

BUILDING 200:

Activity: Produced carbonyl iron powder.

Raw Materials: Sponge iron, hydrogen, carbon monoxide and coke

BUILDING 204:

Activity: Initially a pilot facility used to produce acetylenic products from formaldehyde and acetylene. Later use of the building was for semi-works production of color formers for the former Binghamton photo products plant.

Raw Materials: Inorganic acids and bases, organic solvents including alcohols, heptane and benzene, as well as purchased organic salts were used in this production. Pilot batches of surfactants were made using ethylene oxide, various alcohols, and other organic salts and hydrocarbons.

Byproducts: Organic solvents and acetic acid.

BUILDING 207:

Activity: Used for silver recovery from the film operation, originally a research facility for the Chemical Engineering group in 1970.

Raw Materials: Scrap film, caustic and organic salt

ETHYLENE OXIDE AREA (BUILDINGS 303, 304, 305, 306)

Activity: Produced ethylene oxide.

Raw Materials: Ethylene gas, platinum and silver catalyst.

Byproducts: Glycols

TABLE 2-5

SUMMARY OF TRANSFORMERS PRESENTLY
OR FORMERLY CONTAINING PCB

Aparatus Number	Serial Number	Capacity (Gallons)	Condition
Classified as Non-PCB (<50 ppm)			
OL-10-6	F-956442	160	Concrete Pad, no oil staining
OL-10-6	F-962220	160	Concrete Pad, no oil staining
OL-10-7	F-958205	176	Concrete Pad, no oil staining
OL-10-7	F-956441	176	Concrete Pad, visible oil staining
OL-10-10	8051000	450	Concrete Pad, no oil staining
OL-10-10	D-362843	450	Concrete Pad, no oil staining
OL-10-10	8051001	450	Concrete Pad, no oil staining
OL-10-12	916027	247	Concrete Pad, no oil staining
OL-10-16	YDR-52661	240	Concrete Pad, no oil staining
OL-10-17	F-956774	176	Concrete Pad, no oil staining
OL-10-17	F-687312	330	Concrete Pad, visible oil staining
OL-10-23	E-692843	250	Concrete Pad, no oil staining
OL-10-24	E-695228	176	Concrete Pad, no oil staining
OL-10-26	F-956310	146	Concrete Pad, no oil staining
OL-10-27	E-964486	180	Concrete Pad, no oil staining
Classified as PCB Containing (>50 ppm)			
OL-10-5	E-692622A	295	Indoors, concrete containment
OL-10-5	E-692622B	295	Indoors, concrete containment
BLDG 110 TR	7525815	100	Indoors, concrete containment

Note: PCB classification based on testing conducted subsequent to retrofilling.

TABLE 2-6

SUMMARY OF PREVIOUS ENVIRONMENTAL INVESTIGATIONS

Description	Date	Prepared By
Hydrogeologic Investigation Report	04/83	ERM-Northeast
2,3,7,8-TCDD Sampling	06/83	ERM-Northeast
National Dioxin (2,3,7,8-TCDD) Study Sampling	07/85	USEPA
Final Report of Laboratory Investigations Performed for ETRP	08/86	AWARE, Inc.*
Draft Report of Pilot Plant & Laboratory Scale Toxicity Reduction Investigations	12/86	AWARE, Inc.*
Liner Repairs Project	1986-87	GAF
Building No. 53 Closure Report	03/87	ERM-Northeast
Building No. 53 Confirmation Sampling	03/87	AWARE, Inc.*
Best Management Practices Plan	08/87	GAF
Draft Report of Continuing Phase III ETRP	11/87	AWARE, Inc.*
Building No. 53 Closure Sampling	04/88	AWARE, Inc.*
Results of Ditch Sampling Program During Production Shutdown	08/88	AWARE, Inc.*
Application for Site Designation - Part III	10/88	AWARE, Inc.*
Observe/Split Samples collected NJDEP	12/88	AWARE, Inc.*
Water Level Measurements - Frequent Intervals	05/88 to present	ECKENFELDER INC.
Siting Study, Hydrogeo Data Supplements	02/89 to present	ECKENFELDER INC.

TABLE 2-6 (continued)

SUMMARY OF PREVIOUS ENVIRONMENTAL INVESTIGATIONS

Description	Date	Prepared By
Pilot Treatability Study of Activated Carbon Adsorption of Effluent Toxicity Reduction	07/89	ECKENFELDER INC.
Municipal Site Suitability Study (MSSS) Oversight	6/90 to 1/91	ECKENFELDER INC.

NOTE: * In March 1989, AWARE Incorporated became ECKENFELDER INC.

Other data have been collected in conjunction with the closure of the former hazardous waste storage facility located in Building No. 53. Finally, a significant amount of work has been done in order to upgrade the existing wastewater treatment plant.

2.3 ENVIRONMENTAL SETTING

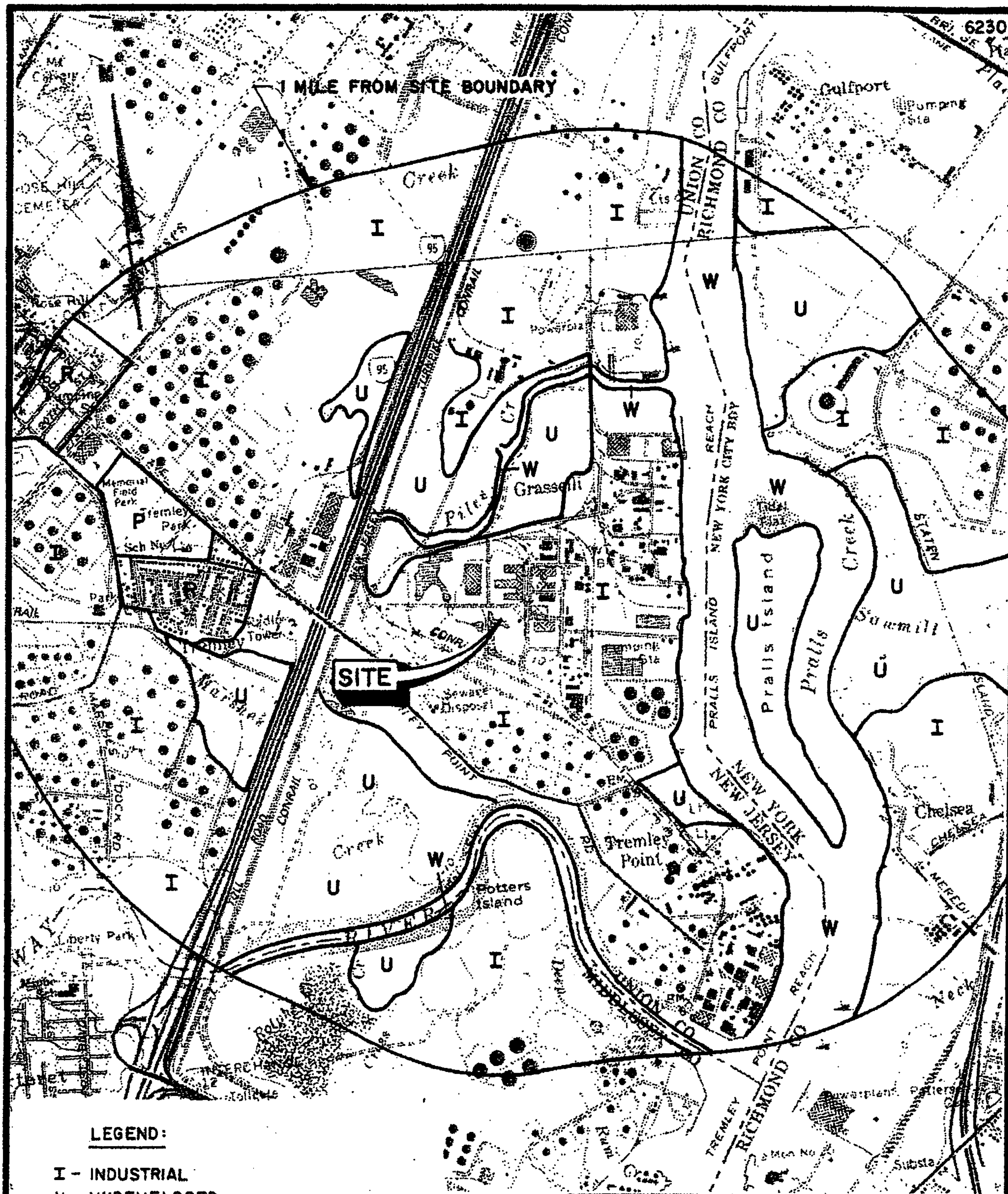
2.3.1 Land Use and Zoning

2.3.1.1 Current Land Use and Zoning. The Site is located between the New Jersey Turnpike and the Arthur Kill in an area that is developed largely for industrial use. Figure 2-2 depicts the land use within a one mile radius from the Site's property boundaries. This land use map is based upon the Land Use Overlay of New Jersey Atlas Sheet No. 26, the USGS topographic quadrangle maps of the area and visual observations of the area.

All developed land immediately adjacent to the Site is industrial in nature. These industrial uses primarily involve chemical manufacturing and the bulk storage of petroleum products and chemicals. Other operations include electrical power generation, municipal wastewater treatment, trucking and warehousing, truck repairing, and barge and boat docking.

The industries located immediately adjacent to the Site include the E.I. Dupont de Nemours Company, to the north and east; the Linden-Roselle Sewerage Authority wastewater treatment plant, to the southwest; and Northvale Industries, Inc. and LCP, Inc., located to the south. Other industries operating within the one mile radius of the Site include the BP Oil Terminal; EFC Land Development; Exxon, Mobil Oil, and Citgo bulk storage facilities; American Cyanamid, and Tremley Point Industries.

Various undeveloped areas are located within one mile of the Site, much of which is unfilled tidal wetland. A relatively large undeveloped area is located directly north of the Site in the vicinity of Piles Creek. Other areas of undeveloped wetland are scattered throughout the area west of the New Jersey Turnpike and south of the Site along the Rahway River wetlands.



LEGEND:

I - INDUSTRIAL
U - UNDEVELOPED
R - RESIDENTIAL
P - PARK
W - WATER

SOURCE: NEW JERSEY ALTAR SHEET No. 26, LAND USE OVERLAY

2000 0 2000

SCALE FEET

MAP LOCATION

FIGURE 2-2

LAND USE MAP

GAF CHEMICALS CORPORATION
LINDEN, N.J.

ECKENFELDER INC.
Nashville, Tennessee
Mahwah, New Jersey

The only area of residential development within one mile of the Site is the Tremley section of Linden located west of the New Jersey Turnpike. A city park and playground is located contiguous with the residential area further to the west.

The closest school to the Site is the Tremley No. 2 school situated approximately 1.5 miles west, on Wood Avenue. The closest hospital to the Site is Rahway Hospital located approximately 3-1/2 miles to the west.

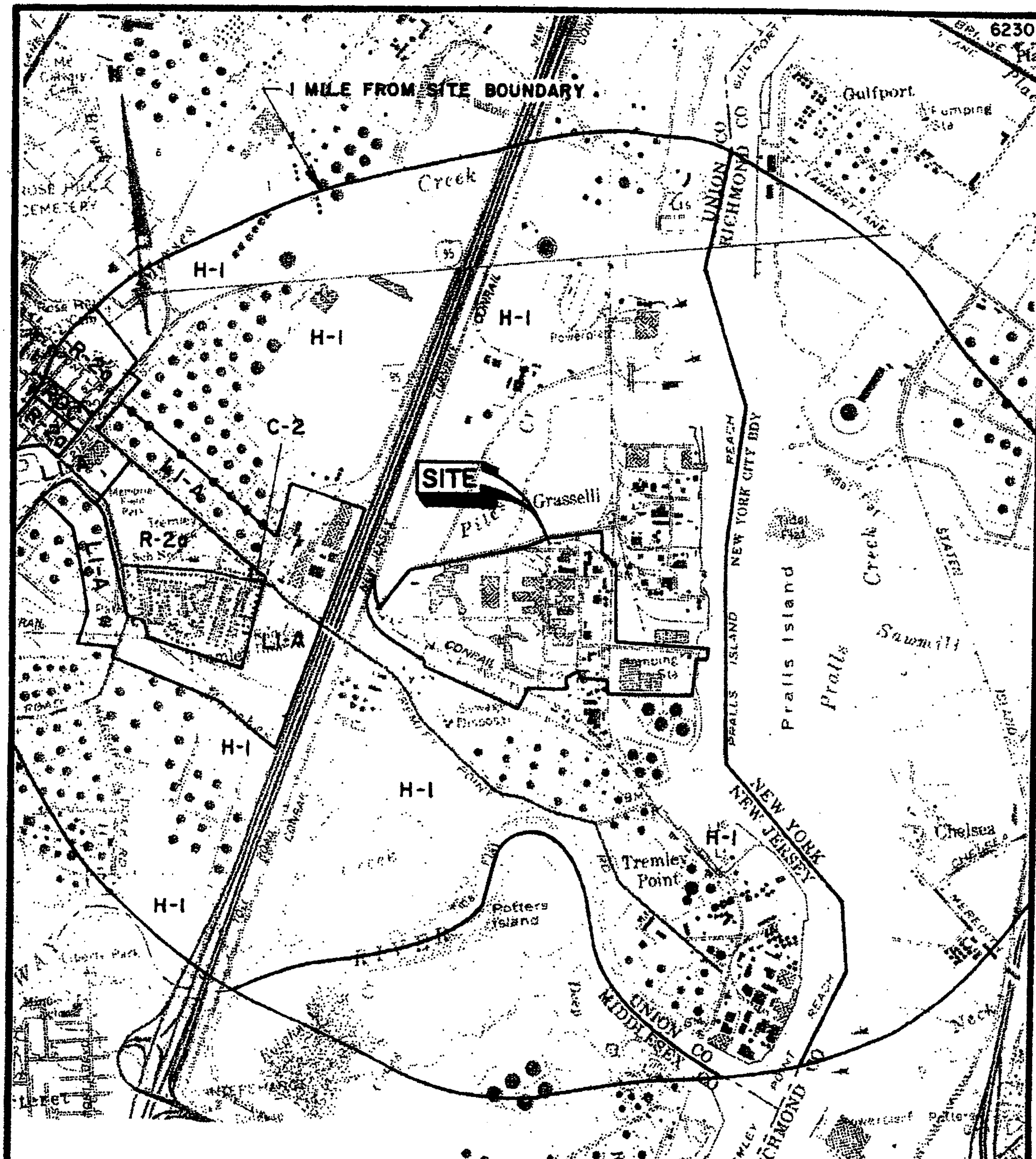
Zoning regulations are in effect for the City of Linden. The zoning within a one mile radius of the edge of the Site is shown on Figure 2-3. This map has been prepared based upon the Zoning Map of the City of Linden (1989).

Most of the land located within a one mile radius and all of the land east of the New Jersey Turnpike is zoned H-I (Heavy Industrial). Immediately on the west of the New Jersey Turnpike from the Site is an area zoned LI-A (Light Industrial). Further to the west, approximately 1,500 feet from the Site, is an area zoned C-2 (Retail Commercial) and R-2a (Two-Family Residential, 50-foot lot).

2.3.1.2 **Future Land Use.** Future uses of the land in the vicinity of the Site are difficult to forecast. However, the zoning regulations, as currently defined, state very specific allowable uses of various land areas.

Much of the area, including all of the area east of the New Jersey Turnpike, is zoned for heavy industry, as previously discussed. Allowable uses for these areas would include all types of manufacturing except explosives, fertilizers, and the use of liquified natural gas; assembly and packaging; warehousing; airports; offices research facilities; service stations and automotive repair shops; public utility generating stations, truck terminals and tank farms. Residential developement is specifically not allowed.

Some of the areas located along South Wood Avenue, west of the New Jersey Turnpike, are zoned for light industry. Allowable uses for these areas would include manufacturing that employs no chemical or raw material processing,



LEGEND:

LI-A - LIGHT INDUSTRIAL
R-2a - TWO FAMILY 50'
C2 - RETAIL COMMERICAL
H-I - HEAVY INDUSTRIAL
ROC - RESIDENTIAL OFFICE COMMERCIAL

SOURCE: ZONING MAP OF THE CITY OF LINDEN (1987)

2000 0 2000

SCALE FEET

MAP LOCATION

FIGURE 2-3

ZONING MAP

GAF CHEMICALS CORPORATION
LINDEN, N.J.

ECKENFELDER INC.

Nashville, Tennessee
Mahwah, New Jersey

assembly and packaging operations, warehousing, airports, offices and research facilities, and service stations and automotive repair shops. Residential development is not allowed.

Other small areas, located west of the turnpike, are zoned as residential and commercial. The residentially zoned area allows the development of one and two family homes, schools, hospitals, places of worship, funeral homes, and cemeteries. The allowable uses of one small commercially zoned area include many types of retail and commercial activities.

The New Jersey State Planning Commission is currently developing a State Development and Redevelopment Plan. Under the Plan, a "tier" strategy of development and planning is described. Implicit within the tier approach is the notion that it is possible for New Jersey to realize its full economic development potential without developing its highest quality agricultural and environmentally sensitive lands or abandoning its older urban centers (New Jersey State Planning Commission, 1988).

A Preliminary Cross-Acceptance Map has been developed as part of the Plan and is being reviewed on the county and local level for final acceptance. On this map, the state is divided into "tiers". The tiers are descriptive of areas as they currently exist and are capable of functioning as planning units. The map reflects information collected by the Office of State Planning regarding current conditions and should not be interpreted as a future land use map. However, general strategies may be interpreted on the regional level as an indication of the direction the State Planning Commission envisions, at this time, for an area (New Jersey State Planning Commission, 1988).

The area in the immediate vicinity of the Site has been designated as Tier 1 (Redeveloping Cities and Suburbs) and is surrounded by areas designated as Tier 2 (Stable Cities and Suburbs). Tier 1 areas are the most distressed municipalities in New Jersey. The critical issues affecting these locales include an eroded economy, middle class exodus, fiscal distress, a deteriorating physical environment, a negative image, and lack of planning capability. The intent of this tier is to alleviate distress through revitalization. "Urban centers" have been identified within the Tier 1 areas and include (within the regional area of the Site) Newark, Elizabeth, Jersey City, Union City, and Perth Amboy. These "urban centers" will qualify for priority treatment with respect to urban policy programming (New Jersey State Planning Commission, 1988).

Tier 2 cities and suburbs are in proximity of Tier 1 municipalities and generally are established and attractive communities. They tend to be almost developed, growing less rapidly than newer municipalities on the metropolitan periphery. The critical issues affecting these areas are maintaining community character, maintaining and improving infrastructure, avoiding increased fiscal distress, accommodating future growth, and lack of comprehensive planning. The goal with respect to this tier is to preserve the character of the community while accommodating moderate growth (New Jersey State Planning Commission, 1988).

The Site is subject to the requirements of the regulations enacted in accordance with the New Jersey Environmental Cleanup Responsibility Act of 1983 (ECRA). ECRA is triggered whenever certain industrial facilities cease operations, as is the case at the Site, and/or when the facilities are subject to transfer of ownership. When ECRA is triggered, significant requirements are imposed on the owner, including the investigation and cleanup of the Site, all of which are subject to close scrutiny by the NJDEP before transfer of ownership can take place. These requirements under ECRA may have the effect of limiting the types of development that could occur at the Site in the future.

2.3.2 Demography

In the following sections, demographic information (including population, economic indicators, and labor information) is presented and discussed. Data are reported for areas in New Jersey within a one mile radius of the Site's boundaries. Much of the data reported are based on 1980 census data. At this time, 1990 census data are not available for use.

2.3.2.1 Population. Population distribution for cities and townships in the vicinity of the Site is summarized on Table 2-7. Included are population data for Elizabeth, Linden, and Rahway cities (of Union County) and Carteret city and Woodbridge Township (of Middlesex County). As shown, Elizabeth city is the most densely populated (8,987 persons per square mile) and also has the largest population (105,150 persons) of the jurisdictional areas evaluated.

Change in population from 1980 to 1988 is also shown in Table 2-7. Union County has experienced an estimated loss in population of 0.8 percent for the period of 1980 to 1988. Elizabeth, Linden, and Rahway cities have either lost or only slightly gained in population (-1 percent, 0.1 percent, and -1.5 percent change in population, respectively). Although Middlesex County experienced a 9.4 percent gain in population over this time period, population change was negative for Carteret (-6.7 percent) and there was only a slight gain (3.3 percent) for Woodbridge Township. These data indicate that, in general, the area in the vicinity of the Site experienced a declining trend in population during the period of 1980 to 1988.

Population projections for Union and Middlesex Counties are presented in Table 2-8. As shown, only a slight increase in population is expected for Union County for the time period 1985 and 2010 (6.6 percent), while a more sizeable increase in population (26.3 percent) is anticipated for Middlesex County during the same time period.

In Table 2-9, population distribution by age group is presented. As shown, the highest percentage of the population for the jurisdictional areas evaluated is within the working age group of 18 to 64 years. The City of Linden has the greatest amount of residents aged 65 years to older (at 14.2 percent) while Middlesex County has the smallest amount (at 8.8 percent). This is also reflected by median age reported with Linden having the highest median age (36.6 years) and Middlesex County having the lowest (30.6 years).

2.3.2.2 Economic Indicators. Per capita income for the jurisdictional areas evaluated is reported in Table 2-10. As shown, in 1987 per capita income for the cities of Elizabeth, Linden, and Rahway were substantially less than that for Union County, with the City of Elizabeth having the lowest

TABLE 2-7

POPULATION DISTRIBUTION IN THE VICINITY OF THE SITE

	Land Area 1980 (sq mi)[a]	1980 Population[b]	Estimated 1988 Population[b]	Estimated 1988 Population Density (Persons/sq mi)[b]	Percent Change (1980-1988)[b]
Union County	103	504,094	499,900	4,853	-0.8
Elizabeth City	11.7	106,201	105,150	8,987	-1
Linden City	11.1	37,836	37,860	3,411	0.1
Rahway City	4	26,723	26,330	6,583	-1.5
Middlesex County	316	595,893	651,700	2,062	9.4
Carteret	4.3	20,598	19,220	4,470	-6.7
Woodridge Twp.	23.1	90,074	93,020	4,027	3.3

[a] US Department of Commerce, 1988. "County and City Data Book, 1988".
[b] US Department of Commerce, 1990. "Local Population Estimates, NORTHEAST, March 1990".

TABLE 2-8

POPULATION PROJECTIONS
FOR UNION AND MIDDLESEX COUNTIES

	1985 Population	Projected 2010 Population	Percent Change (1985-2010)
Union County	506,700	540,000	6.6
Middlesex County	626,700	791,800	26.3

Source: New Jersey State Planning Commission, 1988. "The Preliminary State Development and Redevelopment Plan for the State of New Jersey", November 1988.

TABLE 2-9

1980 POPULATION AGE DISTRIBUTION
IN THE VICINITY OF THE SITE

	Union County	City of Elizabeth	City of Linden	City of Rahway	Middlesex County
Age Distribution (percent)[a]					
Under 5 years	5.6	7.0	5.0	5.8	5.8
6 to 17 years	19.0	18.7	16.4	17.6	20.1
18 to 64 years	62.6	61.2	64.4	65.0	65.3
65 and above	12.8	13.2	14.2	11.6	8.8
Median Age (years)	34.7	32.3	36.6	33.6	30.6

[a]Age distribution given as percentage of total population based on 1980 census data.

Source: Personal Communication, 1991. Telephone conversation between Mr. Ted Bugg (ECKENFELDER INC.) and Information Publications.

TABLE 2-10

PER CAPITA INCOME IN THE VICINITY OF THE SITE

Jurisdiction	1979 ($)	1987 ($)	Percent Increase 1979-87
Union County	9,031	16,140	78.7
Elizabeth	6,712	10,604	58.0
Linden	8,280	13,547	63.6
Rahway	8,295	14,025	69.1
Middlesex County	8,357	15,513	85.6
Carteret	7,724	12,842	66.3
Woodbridge Township	8,463	15,413	82.1

Source: U.S. Department of Commerce, 1990. "Local Population Estimates, NORTHEAST, March 1990".

($10,604). Similarly, the 1979 to 1987 percent increase in income for the City of Elizabeth (58.0 percent) was lower than that for Linden (63.6 percent) or Rahway (69.1 percent). The City of Carteret also had a lower per capita income than the rest of Middlesex County; however, the per capita income reported for Woodbridge Township ($15,413) was very close to the number reported for Middlesex County ($15,513). The 1979 to 1987 percentage increase in per capita income was significantly less for Carteret (66.3 percent) compared to Woodbridge Township (82.1 percent).

Household income data reported for 1979 are shown in Table 2-11. Median household incomes were somewhat higher for Middlesex County ($22,826) compared to Union County ($21,625). The percent of persons living below the poverty level in the City of Elizabeth was a substantial portion of the population (15.8 percent) and was over twice the number for Union County (6.3 percent). A similar trend was reported for families living below the poverty level in 1980 with the percentage reported for the City of Elizabeth being 13.2 percent.

2.3.2.3 Labor Information. Available data on the civilian labor force for cities and counties in the vicinity of the Site are shown in Table 2-12. In 1986, the City of Elizabeth had the largest percentage of unemployed (at 7.9 percent) followed by the City of Linden (5.3 percent), the City of Rahway (5.2 percent), and Middlesex County (4.4 percent).

Employment data by industrial category (1989 data) for Union and Middlesex counties is presented in Table 2-13. Employment trends are similar for both counties. The manufacturing industry accounted for the highest percentage of jobs at 26.3 percent (Middlesex County) and 27.4 percent (Union County). As previously discussed in Section 2.3.1.1, the Site is located in a heavily industrialized area in which chemical manufacturing is a major industry. However, in the State of New Jersey, the number of manufacturing jobs is projected to decline in absolute terms through the year 2000 (New Jersey State Planning Commission, 1988). The services and retail trade industries are also major employers in both counties. The agricultural and mining industry employs only a minor portion of the employed populations in Middlesex and Union counties (0.7 and 0.4 percent, respectively).

TABLE 2-11

1979 HOUSEHOLD INCOME LEVELES IN THE VICINITY OF THE SITE

	Median Household Income ($)	Percent Below Poverty Level	
		Persons	Families
Union County	21,625	7.5	5.8
Elizabeth	--[a]	15.8	13.2
Linden	--	7.0	5.3
Rahway	--	6.0	4.3
Middlesex County	22,826	6.3	4.7

[a]Dashes indicate that data were not reported.

Source: U.S. Department of Commerce, 1988. "County and City Data Book, 1988".

TABLE 2-12

1986 UNEMPLOYMENT DATA FOR JURISDICTIONAL AREAS IN THE VICINITY OF THE SITE

	Total Civilian Labor Force 1986	Unemployment 1986	
		Total	Percent of Total Civilian Labor Force
Union County	274,042	14,875	5.4
Elizabeth	56,387	4,473	7.9
Linden	20,310	1,079	5.3
Rahway	15,234	790	5.2
Middlesex County	359,538	15,717	4.4

Source: U.S. Department of Commerce, 1988. "County and City Data Book, 1988".

TABLE 2-13

EMPLOYMENT BY INDUSTRIAL CATEGORY

MIDDLESEX AND UNION COUNTIES, SEPTEMBER 1989

Industry	Middlesex County			Union County		
	No. of Establishments	Total Employment	Percent of Total Employed	No. of Establishments	Total Employment	Percent of Total Employed
Agriculture and Mining	274	2,154	0.7	235	1,062	0.4
Construction	1,828	13,782	4.5	1,522	11,269	4.8
Manufacturing	1,092	80,014	26.3	1,168	63,614	27.4
Transportation	702	13,327	4.4	654	16,257	7.0
Communications and Utilities	97	9,271	3.0	76	4,552	2.0
Wholesale Trade	1,764	35,503	11.7	1,537	22,951	10.0
Retail Trade	3,258	55,696	18.3	2,775	34,650	14.9
Finance, Insurance and Real Estate	1,023	24,670	8.1	1,083	14,784	6.4
Services	4,985	69,935	23.0	4,651	62,959	27.1
TOTAL	15,023	304,352	100	13,701	232,098	100

Source: New Jersey Department of Labor, 1990. "Quarterly Report of Employment and Wages Covered by Unemployment Insurance, Third Quarter 1989".

2.3.2.4 Summary of Demographic Characteristics. In summary, the New Jersey jurisdictional areas within a one-mile radius of the property boundaries is experiencing either a decline or only very slight increase in population. Only a small increase in population is projected in Union County to the year 2010 (6.6 percent increase) and a somewhat greater increase is projected for Middlesex County (26.3 percent). The majority of the population living in the vicinity of the Site is of working age (18 to 64 years old). Of the jurisdiction areas evaluated, the City of Linden has the highest percentage of residents over the age of 65 years and also the highest median age (36.6 years).

Per capita income in 1987 for the cities of Elizabeth, Linden, Rahway, and Carteret is substantially less than their respective counties. The lowest per capita income ($10,604) was reported for the City of Elizabeth. The percentage of persons and families living below the poverty level was also highest for the City of Elizabeth and represents a substantial portion of the population (15.8 and 13.2 percent, respectively). The percentages of persons and families living below the poverty level for the remaining jurisdictional areas were 7.5 percent or less and 5.8 percent or less, respectively.

The percentage of the total civilian labor force that was unemployed ranged from 4.4 percent (Middlesex County) to 7.9 percent (City of Elizabeth) in 1986. The majority of the work force in Middlesex and Union counties was employed in the manufacturing, services, and retail trade industries as of September 1989.

These demographic data support the classification of the area in the vicinity of the Site as a "Tier 1" area. As discussed in Section 2.3.1.2, Tier I areas are those which are experiencing an eroded economy, middle class exodus, and fiscal distress. It is the intention of the New Jersey State Planning Commission to alleviate distress through revitalization in the future (New Jersey State Planning Commission, 1988).

2.3.3 Climate and Meteorology

Climatological data are recorded at the NOAA measuring station located at Newark Airport in Newark, New Jersey. The Site is located approximately seven miles south of the recording station. The elevation and topographic setting of the Site are very similar to that of the NOAA station such that the NOAA data provide an accurate representation of the climatology of the Site.

The climatology for the area was obtained from "Local Climatological Data, Annual Summary with Comparative Data, (NOAA, 1987) and monthly summaries up through 1990 (NOAA). Mean temperature and precipitation data contained therein are based upon a thirty-year period of record from 1951 to 1980 referred to as "normals". Wind direction and speeds are based upon records since 1944.

<u>Temperature</u>

Average daily temperatures in the lower New York Bay region range from a normal daily maximum of 85.6°F in July to a normal daily minimum of 38.2°F in January (Table 2-14). The normal monthly temperatures range from 76.8°F to 31.3°F and occur in the months of July and January, respectively. The average 30-year normal of the average monthly temperatures for the period of record is 54.2°F. The average normal daily maximum is 62.5°F and the average normal daily minimum is 45.9°F. Although the average normal monthly temperature varies greatly, with an average deviation of 14.3°F, these temperatures occur in a relatively normal distribution (Figure 2-4), with July being the warmest month and January and December comprising the colder months on either side of the temperature distribution. Occurrences of extreme temperatures have been recorded as high as 105°F in July of 1966 and as low as -8°F in January of 1985.

<u>Precipitation</u>

The 30-year normal of the annual precipitation is recorded as 42.34 inches (Table 2-15). The annual precipitation is fairly uniformly distributed throughout the year (Figure 2-5) with a mean deviation of 0.30 inch. The

TABLE 2-14

TEMPERATURE DATA
NEWARK, NEW JERSEY
(Degrees Fahrenheit)

Month	Mean temperature 1951-1980	1989
January	31.3	37.0
February	32.8	34.2
March	41.2	42.4
April	52.1	52.5
May	62.3	63.2
June	71.5	74.3
July	76.8	77.2
August	75.5	76.3
September	68.2	69.9
October	57.2	59.1
November	46.5	45.0
December	35.5	25.6
Annual	54.2	54.7

SOURCE: NOAA (1987)

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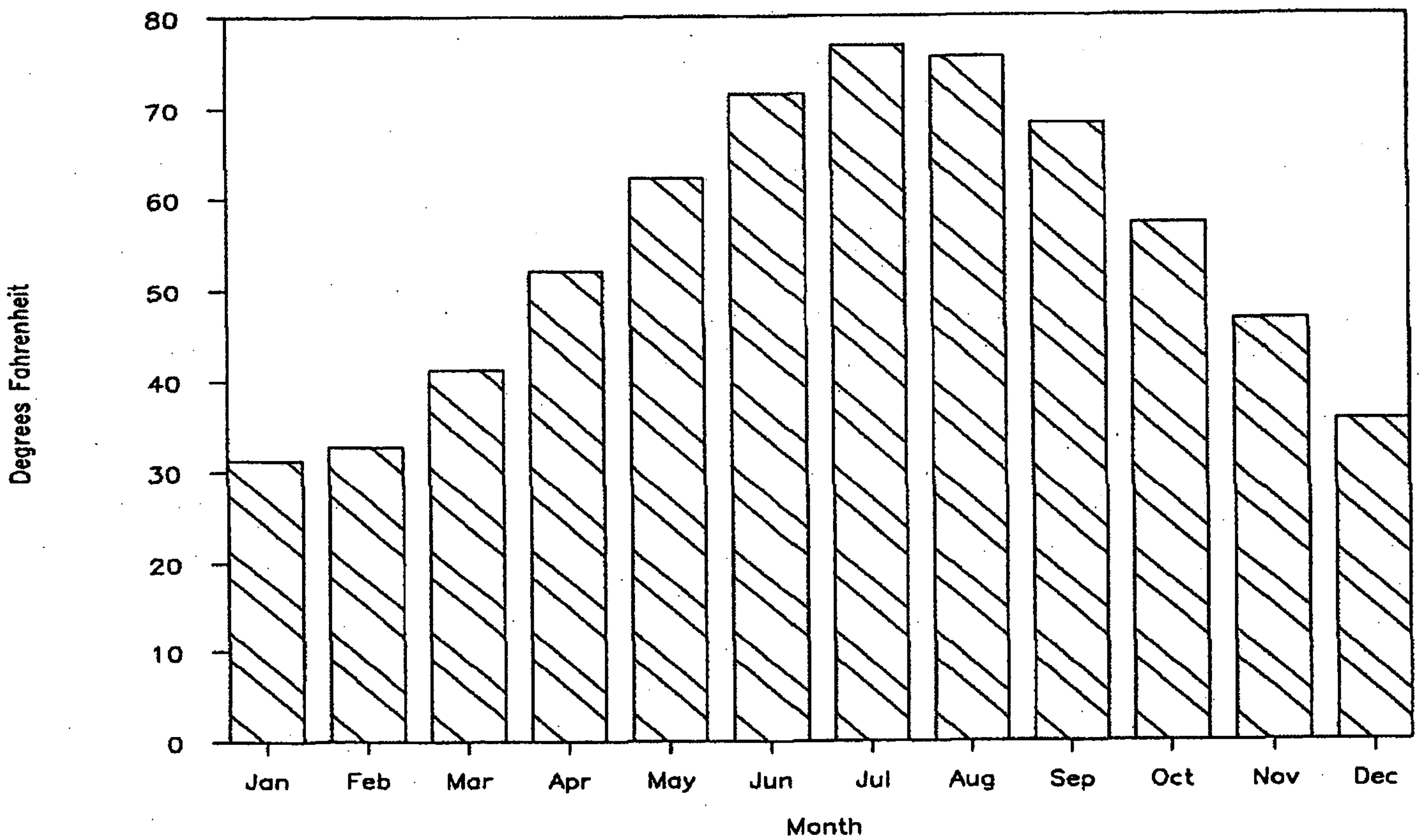


SOURCE: NOAA (1987)

FIGURE 2-4

MEAN MONTHLY TEMPERATURE
(1950–1987)

NEWARK, NEW JERSEY

ECKENFELDER INC.

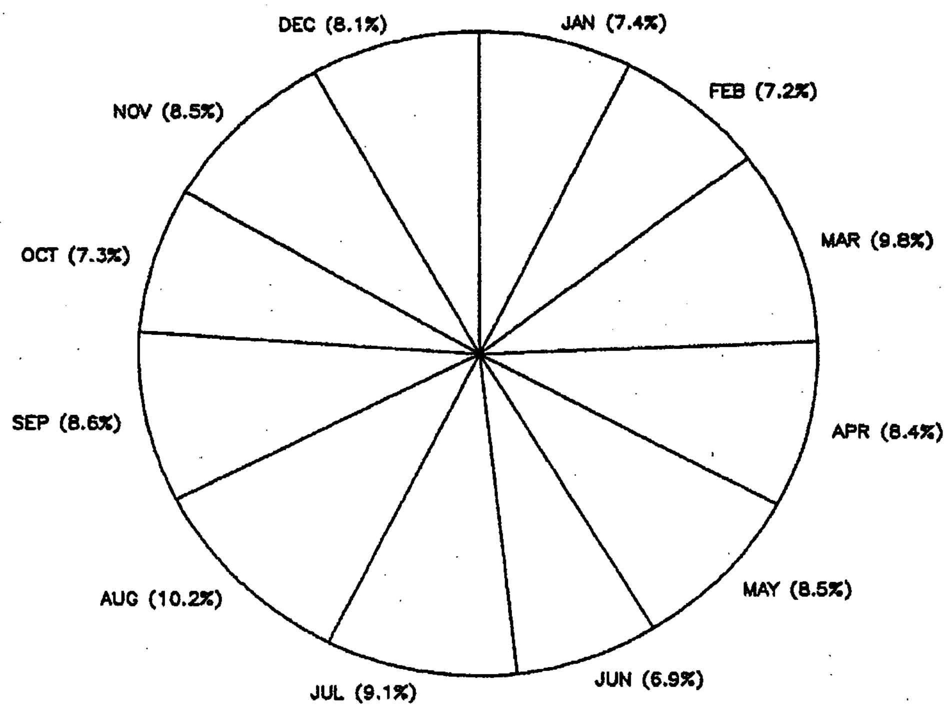
Nashville, Tennessee
Mahwah, New Jersey

TABLE 2-15

PRECIPITATION DATA SUMMARY
NEWARK, NEW JERSEY
(Inches)

Month	Mean Precipitation 1951-1980	Total Precipitation 1989	Total Precipitation 1990
January	3.13	1.98	4.72
February	3.05	2.70	1.71
March	4.15	4.42	2.81
April	3.57	3.25	3.98
May	3.59	8.80	6.87
June	2.94	5.41	3.68
July	3.85	5.23	4.98
August	4.30	7.03	7.71
September	3.66	6.45	2.72
October	3.09	5.40	5.11
November	3.59	2.57	2.82
December	3.42	0.75	5.19
Annual	42.34	53.99	52.30

SOURCE: NOAA (1987)



SOURCE: NOAA (1987)

FIGURE 2-5

PRECIPITATION DATA SUMMARY
(1951-1980)

NEWARK, NEW JERSEY

ECKENFELDER INC.

Nashville, Tennessee
Mahwah, New Jersey

years 1989 and 1990 were wetter than normal with total precipitation amounts that were 11.65 and 9.96 inches above the mean, respectively. Extreme monthly precipitation values have been reported as high as 11.84 inches in August 1955 and as low as 0.07 inch in June 1949. The mean maximum precipitation for a 24-hour period is reported as 7.84 inches in August 1971.

Relative humidity for the region averages 73 percent at sunrise (0700 hours) and 61 percent at sundown (1900 hours). Although slightly higher relative humidity readings are reported for the months of August through December, mean monthly readings occur in a generally uniform distribution throughout the year.

Prevailing Wind Direction and Speed

The prevailing wind direction for the area is from the southwest as determined by data compiled by NOAA, since 1944. A consistent southwest wind direction is observed during the months of May through December; variable wind directions (from the northeast, northwest, and west-northwest) occur during the months of January through April.

The mean prevailing wind speed is reported as 10.2 miles per hour (mph), and varies from 12.0 mph in February to 8.7 mph is August (Table-2-16). Higher mean wind velocities occur during the months of January through May, while lower velocities are observed in the months of June through October. The highest wind speed (fastest observed one min value) recorded at the Newark Weather Station is 82 mph in November 1950. The next highest wind speed is recorded at 58 mph in December 1984.

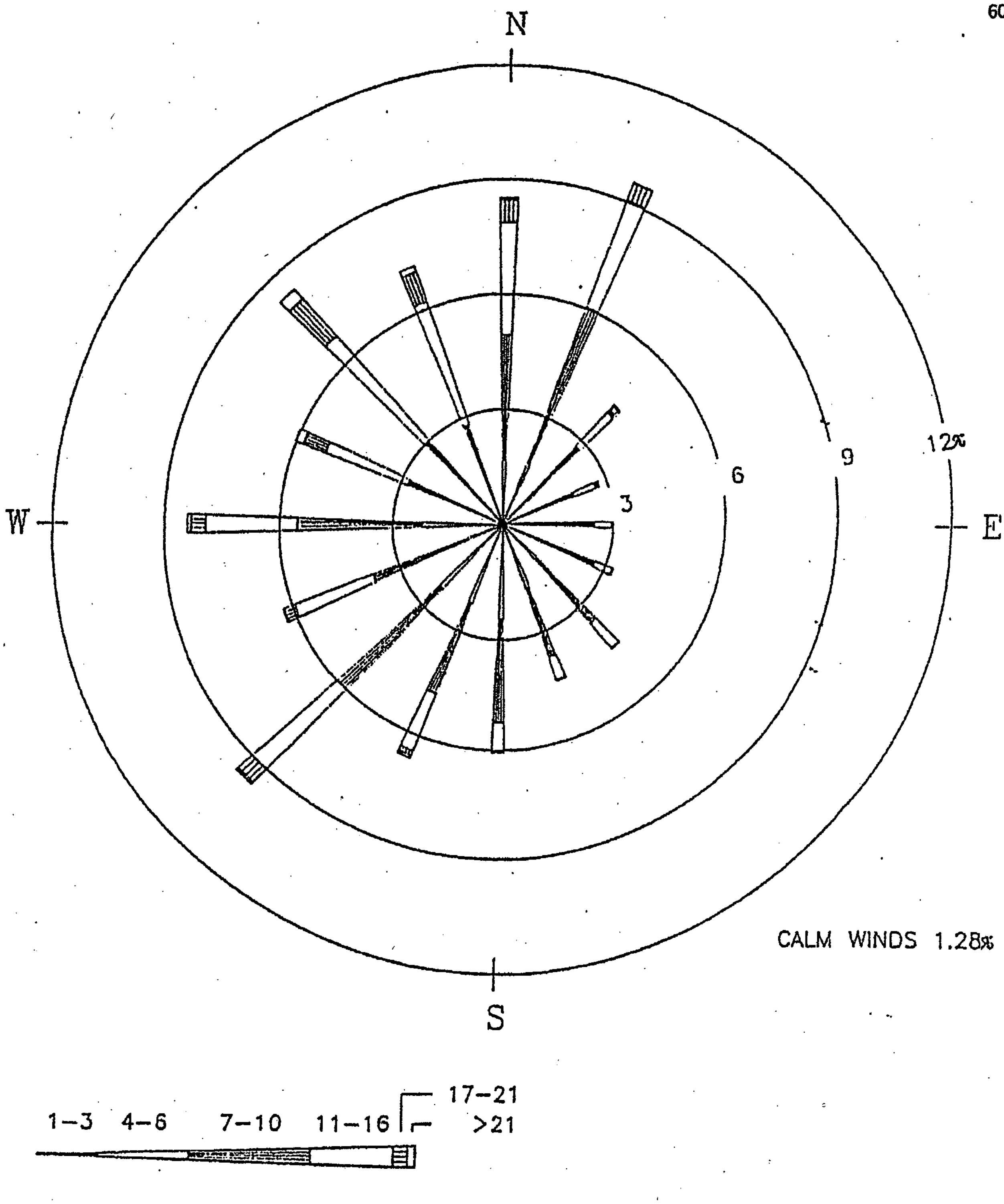
A typical frequency distribution of wind speed and direction at the Newark Weather Station is depicted in the rose diagrams based on 1986 data (Figure 2-6). As shown by this diagram, the prevalent wind directions are from the north-northeast, west, and southwest. The wind blows from the east or southeast, or to the west or northwest, only a relatively small percentage of the time, and at low velocities.

TABLE 2-16

WIND DATA SUMMARY
NEWARK, NEW JERSEY
(MPH)

Month	Mean Wind Speed	Mean Wind Direction
January	11.3	NE
February	11.6	NW
March	12.0	NW
April	11.4	WNW
May	10.1	SW
June	9.5	SW
July	8.9	SW
August	8.7	SW
September	9.0	SW
October	9.4	SW
November	10.2	SW
December	10.7	SW
Annual	10.2	SW

SOURCE: NOAA (1987)



WIND SPEED CLASSES
(KNOTS)

NOTES:
DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING. EXAMPLE – WIND IS BLOWING FROM THE NORTH 8.5 PERCENT OF THE TIME.

FIGURE 2-6

WINDROSE
STATION NO. 14734

NEWARK, NEW JERSEY
PERIOD: 1986

ECKENFELDER INC.

Nashville, Tennessee
Mahwah, New Jersey

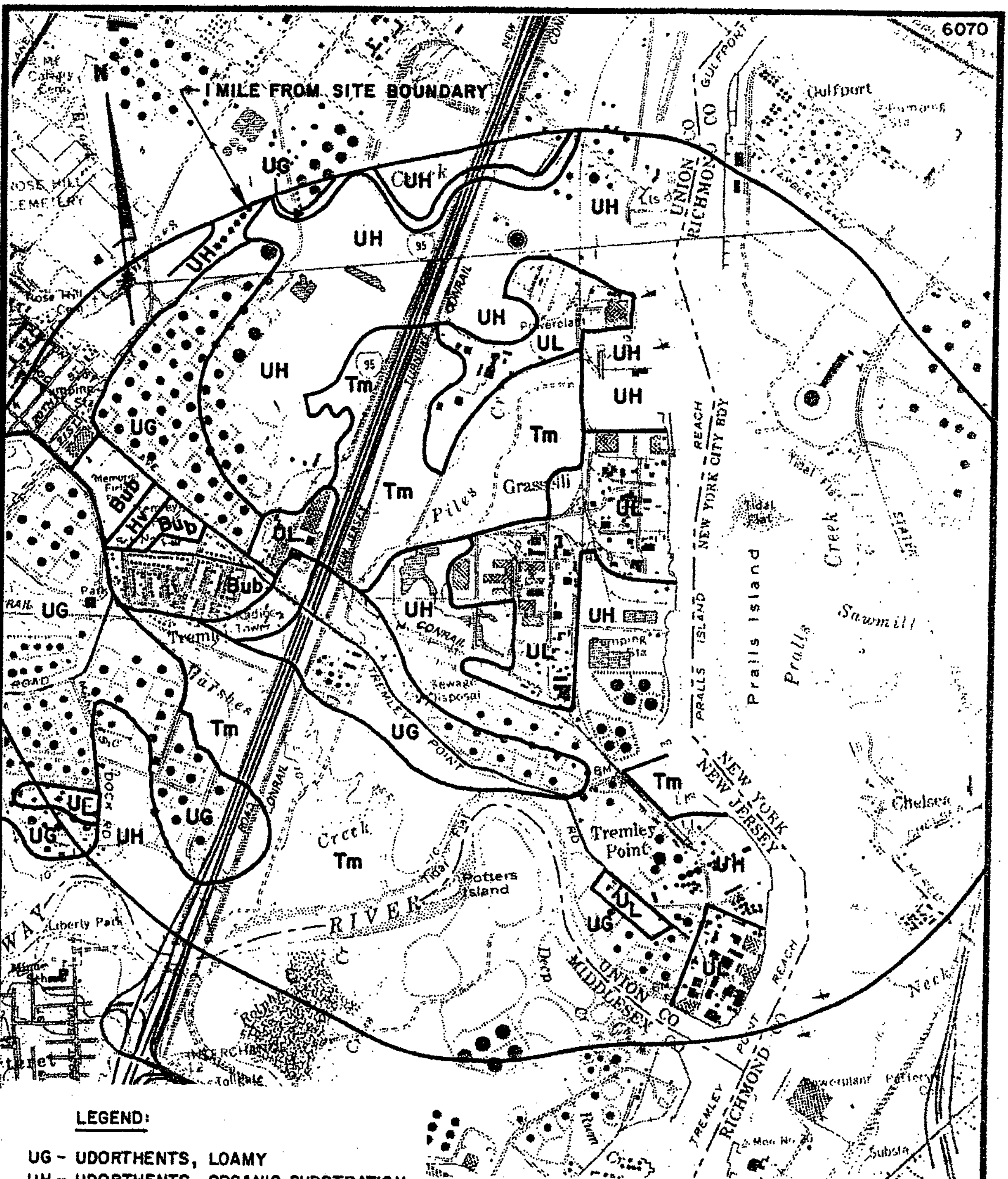
2.3.4 Soils

2.3.4.1 Soils Classification. The surficial soils in Union County have been mapped by the U.S. Department of Agriculture, Soil Conservation Service (SCS) in cooperation with various local agencies. The surficial soil data are available in a draft report (SCS, 1991). The soil classifications, as designated by SCS, are presented on Figure 2-7 for the area in and around the Site.

Most of the soils in the area of the Site are classified as Udorthents. Udorthents are defined as soils formed in cut and fill areas. In the context of the area around the Site, udorthents represent manmade emplaced fill materials. Much of the fill overlies an organic substratum that represents the tidal marshes that formerly occupied most of the area, designated on the map with an "UH" symbol. Other areas of udorthents are defined as loamy and are found predominantly along South Wood Avenue and Tremely Point Road, identified with an "UG" symbol. The loamy udorthents (UG) are presumed to be areas that were formerly high ground covered with man-emplaced fill. Other soil designations that are predominant at the Site include undefined soils termed "Urban Land", identified with an "UL" and areas of undisturbed tidal marsh, noted as "Tm".

Two other soil types are mapped by SCS, predominantly in the residential area located west of the Site. These include "Booton, Urban Land", identified as "Bub" and the "Hasbrouck Silt Loam", shown with an "Hv" symbol. These mapped units and the loamy udorthents likely represent some of the only areas near the Site that historically were high ground and were not tidal marsh, as were nearly all of the other areas in the vicinity of the Site.

2.3.4.2 Typical Concentrations of Elements in Soils. Data on typical concentrations of the various elements in soils are summarized in Table 2-17. Included are typical ranges of concentrations and extreme concentration limits (Dragun, 1988) and ranges in concentration for the eastern United States and north central New Jersey (Shacklette and Boerngen, 1984). The data presented are those which were available for the inorganic parameters analyzed for as part of the RI investigation.



LEGEND:

UG - UDORTHENTS, LOAMY
UH - UDORTHENTS, ORGANIC SUBSTRATION
UL - URBAN LAND
Tm - TIDAL MARSH
Bub - BOONTON, URBAN LAND
Hv - HASBROUCK, SILT LOAM

SOURCE: U.S. DEPARTMENT OF AGRICULTURE, 1991

2000 0 2000
SCALE FEET

MAP LOCATION

FIGURE 2-7

SOILS MAP

GAF CHEMICALS CORPORATION
LINDEN, N.J.

ECKENFELDER INC. Nashville, Tennessee Mahwah, New Jersey

TABLE 2-17

TYPICAL CONCENTRATIONS OF TARGET ANALYTE METALS
IN U.S. SOILS

Constituent	Typical Range in Concentration a. (mg/kg)	Extreme Limits b. (mg/kg)	Range of Concentration in Eastern U.S. b. (mg/kg)	Range of Concentration in North central New Jersey b. (mg/kg)
Antimony	0.6 - 10	--	<1 - 8.8	<1 - 10
Arsenic	1.0 - 40	0.1 - 500	0.1 - 73	6.5 - 10
Barium	100 - 3,500	10 - 10,000	10 - 1,500	150 - 200
Beryllium	0.1 - 40	0.1 - 100	<1 - 7	1.5 - 15
Cadmium	0.01 - 7.0	0.01 - 45	--	--
Chromium	5.0 - 3,000	0.5 - 10,000	1 - 1,000	70 - 2,000
Copper	2.0 - 100	0.1 - 14,000	<1 - 700	30 - 700
Iron	7,000 - 550,000	--	100 - 100,000	30,000 - 100,000
Lead	2.0 - 200	0.1 - 3,000	<10 - 300	20 - 700
Manganese	100 - 4,000	1.0 - 70,000	<2 - 7,000	700 - 7,000
Mercury	0.01 - 0.08	--	0.01 - 3.4	0.032 - 0.051
Nickel	5.0 - 1,000	0.8 - 6,200	<5 - 700	20 - 700
Selenium	0.1 - 2.0	0.01 - 400	<0.1 - 3.9	<0.1 - 0.1
Silver	0.1 - 5.0	0.1 - 50	--	--
Thallium	0.1 - 12	--	2.2 - 23	--
Vanadium	20 - 500	1.0 - 1,000	<7 - 300	100 - 500
Zinc	10 - 300	3.0 - 10,000	<5 - 2,900	74 - 3,500

Notes:

a. Dragun, J., 1988.

b. Shacklette, H.T. and J.G. Boerngen, 1984.

2.3.5 Surface Water

2.3.5.1 Regional Surface Water Features. Tidal marsh formerly covered the entire area in which the Site is now located. All developed land in the area necessarily constitutes man-emplaced fill material laid over the former tidal marsh. Therefore, the topography of the area is relatively flat, with an elevation of only a few feet above sea level.

The Site is almost entirely surrounded by tidal water bodies. Most prominent among these is the Arthur Kill, which is large body that connects with Newark Bay to the north and Raritan Bay to the south. A small tidal creek flowing into the Arthur Kill, Piles Creek, is located to the north of the Site. To the south and west of the Site are the tidal bodies flowing into the Arthur Kill represented by the Rahway River and it's tributaries, Marshes Creek and South Branch Creek. None of these surface water bodies presently flow into or through the Site.

Other tidal streams located further from the Site include Morses Creek and the Elizabeth River which flow into the Arthur Kill north of the Site; and Kings Creek, which is another small tributary of the Rahway River located west of the Site. A number of tidal creeks enter the Arthur Kill from Staten Island including, from north to south, Old Place Creek, Pralls Creek, Sawmill Creek, Neck Creek and Fresh Kills. The locations of each of the surface water bodies are depicted on Figure 2-8.

Some unfilled areas presently remain in the vicinity of the Site. These areas are represented as tidal marsh and tidal flats.

2.3.5.2 Surface Water Designated Uses. As shown in Figure 2-8, surface water bodies surrounding the Site include the Arthur Kill (to the east), Piles Creek (to the north), the Rahway River (to the south), and Marshes Creek (to the west). As discussed previously, these surface water bodies are tidal.

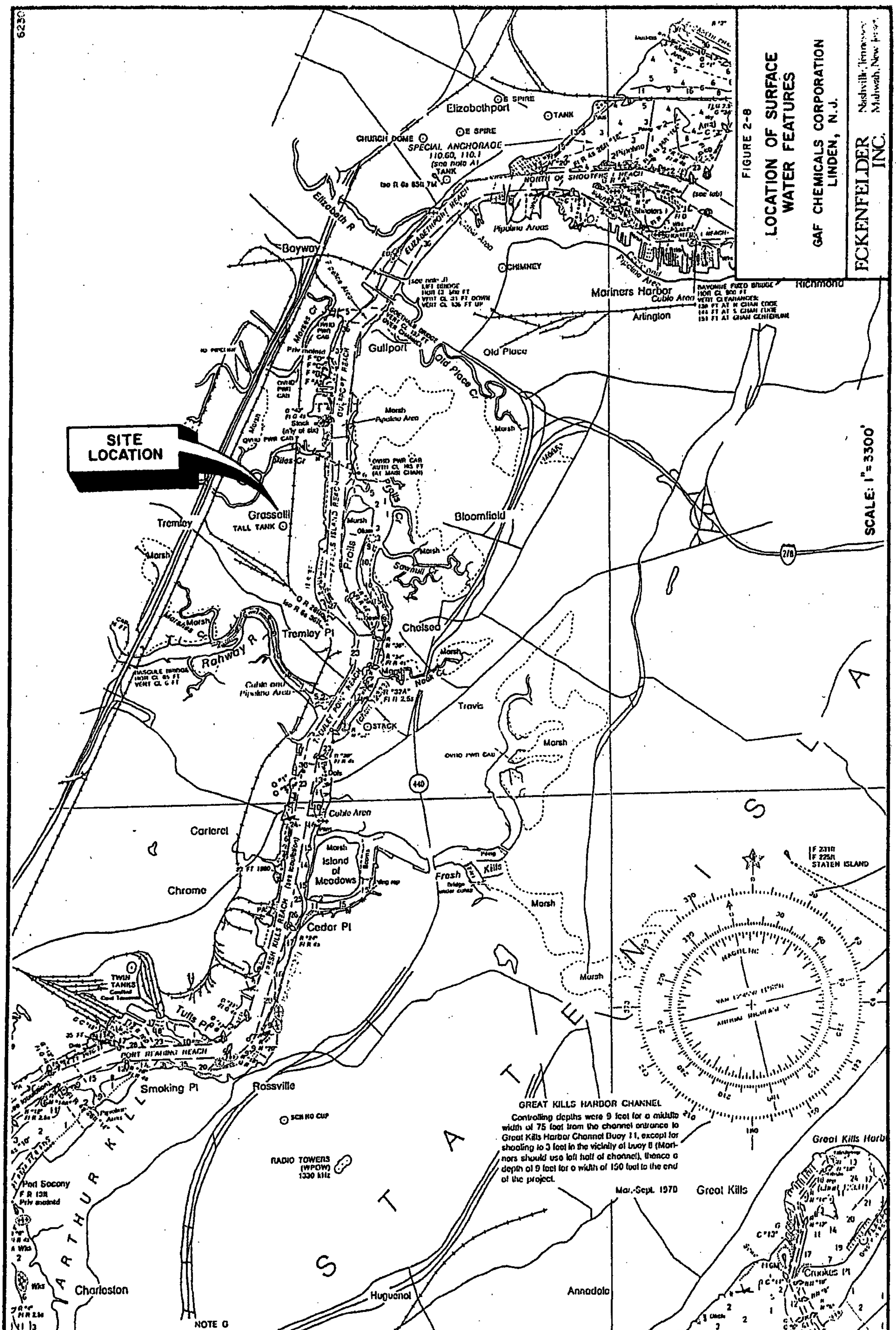


FIGURE 2-8
LOCATION OF SURFACE WATER FEATURES
GAF CHEMICALS CORPORATION
LINDEN, N.J.

Under the New Jersey Surface Water Quality Standards (NJSA 7:9-4.1, et seq.; NJDEP, 1985), these surface water bodies are located within the New York Harbor Complex basin. The Arthur Kill, Piles Creek, and Rahway River are classified as "SE3". Waters which are classified as "SE3" are saline waters of estuaries and have the following designated uses:

- Secondary contact recreation
- Maintenance and migration of fish population
- Migration of diadromous fish
- Maintenance of wildlife
- Any other reasonable uses

Under this classification, secondary contact recreation refers to recreational activities where the probability of water ingestion is minimal and includes, but is not limited to, boating and fishing. Secondary contact recreation would not include such activities as wading, swimming, or water skiing (NJDEP, 1985). Diadromous fish are those which spend most of their life in one type of water (either fresh or saline) and migrate to the other water type to spawn.

A designated use has not been assigned to Marshes Creek. However, unclassified saline waterways which enter SE3 waters in the New York Harbor Complex basin are classified as SE2. Designated uses for SE2 waters are the same as SE3 waters except that SE2 designated uses include maintenance, migration, and propagation of the natural and established biota (instead of the maintenance and migration of fish populations use for SE3).

2.3.5.3 Flood Hazard. The Site is not subject to riverine flooding. However, the Site is subject to coastal tidal flooding. The 100-year tidal flood elevation has been established at nine feet above mean sea level (msl), a level that would flood most of the Site.

According to the flood insurance studies for the City of Linden, Union County, New Jersey (May 1976) and for the City of New York, New York (includes Staten Island; May 1983), various areas of the City of Linden are subject to both tidal and fluvial (riverine) flooding, although tidal wave velocities are dampened by the meanders of the stream channels. This tidal influence is less severe than the fluvial flooding along local waterways. Five (5) waterways account for all fluvial and tidal flooding. The City of Linden is subject to fluvial flooding along Morses Creek, Peach Orchard Brook, and Kings Creek. Fluvial flooding is caused by rivers and streams overflowing their banks. The Arthur Kill and the Rahway River account for tidal flooding in the area. Water levels in these waterways are controlled by tidal conditions.

The Site is bounded to the east by the Arthur Kill. The Kill is a tidal channel which joins Newark Bay and Raritan Bay. Piles Creek, a tributary of the Arthur Kill, flows along the north-northwest portion of the property. The Arthur Kill (and its tributaries) are subject to tidal and coastal flooding influence and are not subject to riverine flood hazards. In addition, the facility is located outside of the influence of fluvial flooding by Morses Creek, Peach Orchard Brook, and Kings Creek. Therefore, the Site is not subject to riverine flooding.

Coastal flooding is caused by long and short wave surges that affect the shores of the open ocean, bays, and tidally influenced rivers, streams, and inlets (such as the Arthur Kill). The movement of coastal waters is influenced by the astronomic tide and meteorological forces such as northeasters and hurricanes. Flooding is primarily the result of storm surges, wave setup, and wave runup which occur during hurricanes and northeasters.

The 100-year flood elevation data for the Arthur Kill in the vicinity of the Site are presented in three Flood Insurance Studies prepared by the Federal Emergency Management Agency, as follows:

- City of Linden, Union County, New Jersey, May 1976.

- City of Elizabeth, Union County, New Jersey, November 1, 1985.

- City of New York, Bronx, Queens, New York, Kings and Richmond Counties, New York, May 16, 1983.

Flood elevation data from these studies, for the 100-year event, in the vicinity of the Site may be summarized as follows:

Location	Elevation	Source
At Victory Boulevard approximately one mile south of the Site	8.6 feet	City of New York
At confluence with Elizabeth River, approximately three miles north of the Site	8.3 feet	City of Elizabeth
Approximately four miles south of Goethals Bridge, approximately 1.5 miles south of the Site	8.6 feet	City of Elizabeth
Reach of Arthur Kill adjacent to City of Linden	11.5 feet	City of Linden

A review of the above data indicates consistency of the data between the Elizabeth and New York studies but a difference from the Linden study. The Linden study, performed in 1976, presented detailed hydrologic and hydraulic analyses for fluvial flooding (i.e., non-tidal). However, actual methods of analyses for tidal flooding along the Arthur Kill are not presented in the study. The study deals with tidal flooding solely through reference to a figure of total tide versus frequency. The source or derivation of the tide data are not provided. In addition, the Linden study references benchmarks and a datum established in 1928 for the City of Linden and it is unclear how this datum may relate to the National Geodetic Vertical Datum of 1929 (NGVD) used in later studies, as discussed below.

By contrast, the study for the City of New York presents a detailed description of methods of analyses for the determination of tidal flood elevations. In particular, this study used mathematical modeling and waterway geometry to generate synthetic storm surges. The modeling was then calibrated and verified against three hurricanes and 13 historical northeasters. Further, observed historical data were used to develop storm surge distributions. Statistical analyses were then applied to define still water (tidal) elevations at specific recurrence intervals. The methods of analysis were developed for the New York State Department of Environmental Conservation (NYSDEC) and were documented in this flood insurance study.

The City of Elizabeth study (borders Linden to the North) adopted the data generated from the New York City study for the Arthur Kill. No additional analyses were performed. Also, data for the New York City and Elizabeth studies are based upon the National Geodetic Vertical datum of 1929. There is, therefore, no uncertainty as to the elevation reference for these flood studies and the associated flood data.

Given the above, the more accurate, thoroughly analyzed, and most recent 100-year flood elevation data are those embodied in the City of Elizabeth and City of New York studies. For insurance purposes, the flood elevations are rounded and an elevation of nine feet (NGVD) is typically referenced out of the above-noted flood insurance studies. This analysis of the Linden flood elevation has received the concurrence of the NJDEP in a letter from Thomas Sherman of the Bureau of Hazardous Waste Engineering, dated November 17, 1989. It should be noted that FEMA is currently conducting a restudy of the City of Linden, which should serve to confirm the nine-foot elevation.

2.3.6 Site Drainage

A ditch system is utilized for the conveyance of plant surface water to the waste water treatment plant (WWTP). This ditch system consists of narrow wood walled trenches in the east-central portion of the Site. In the central and western areas of the Site, the ditch system is significantly wider without wood walls. The ditch system is characterized as a large ponded area in the northwestern corner of the Site (Drawing No. 6070-003).

Drainage from most of the plant buildings, including roof drains and process water, is directed to the WWTP ditch system. This is often accomplished by a connection to the ditch system from the open ponded areas that exist beneath many of the buildings either through a pipe or through a small tributary ditch.

Several other small ditches exist on the Site that are not connected to the WWTP, each of which primarily conveys surface water drainage. One of these flows along the north property line, north of the WWTP, to the Arthur Kill. Another flows south along the railroad track to discharge to South Branch Creek. These are to be connected to the WWTP within the next 6-9 months as soon as NJDEP wetlands permits are issued.

An evaluation has been made regarding the surface water drainage patterns of specific areas of the Site. This evaluation was conducted through a detailed review of the Site's topographic map, coupled with a limited field confirmation. The stormwater drainage patterns are depicted on Sheet 6070-007.

The following conclusions are made with regard to the surface water drainage from the 147 acres that constitute the Site:

- Approximately 78 acres (53 percent of the Site) drains directly to the WWTP ditch system.

- Approximately 40 acres (27 percent of the Site) drains off of the Site.

- Approximately 29 acres (20 percent of the Site) consists of undrained, shallow depressions which neither flow to the WWTP ditch system or off of the Site.

2.3.7 Regional Hydrogeologic Conditions

The Site is underlain by a continuous series of consolidated and unconsolidated geologic materials. The unconsolidated materials include man-emplaced fill that is sequentially underlain by Tidal Marsh deposits, Glacial Till, and decomposed bedrock (residual soil). These materials are underlain by the shales and siltstones of the Passaic formation.

Two distinct water-bearing zones have been observed beneath the Site:

- An upper water-bearing zone within the Fill and the Peat subunit of the Tidal Marsh deposits.

- An aquifer contained within the upper portion of the Passaic formation bedrock. The bedrock aquifer is confined by an aquitard comprised of the Silt & Clay subunit of the Tidal Marsh deposits and the Glacial Till.

The hydrogeologic conditions are described in detail, both on a regional and a site-specific basis, in Section 4.

2.3.8 Groundwater Usage

Surface and groundwater withdrawal data, obtained from NJDEP, Bureau of Water Allocation, indicate that no potable water supply wells exist within a two mile radius of the Site. Due to the proximity of the Arthur Kill and other tidal waters to Linden, groundwater found in this region, including the Passaic bedrock aquifer(s), is typically brackish (Anderson, 1968). Untreated, brackish water exceeds the New Jersey Safe Drinking Water Standards for salinity, making this area undesirable for public supply wells.

Regionally brackish groundwater concentrations tend to diminish gradually with increasing distance from the source waters. Data supplied by the NJDEP (Appendix B) indicates that within a five mile radius, and located upgradient and west of the facility, both industrial and municipal water supply wells are used. Within this radius, the Passaic formation has been extensive developed as the primary water supply source. The depths of these wells range from 75 to 570 feet and yield volumes of water between 100 and 400 gallons per minute. Locally occurring unconsolidated aquifers have also been tapped for water supply within this region. Relatively fewer in number, these aquifer(s) serve as the primary public water source for the Rahway area. Also, some shallow supply wells screened in the Quaternary sand and gravel and yielding up to 300 gallons of water per minute are used as a source of industrial waters.

Seventeen water withdrawal points, all of which are located either upgradient or lateral to the direction of groundwater flow, are located within a two to five-mile radius surrounding the Site. The closest well is located approximately two miles to the northwest. All of these wells are located either upgradient or lateral to the direction of groundwater flow. Six supply wells, owned and operated by the Elizabethtown Water Company, are located approximately four miles to the northwest. Elizabethtown Water Company is the primary supplier of potable water to Linden, New Jersey. Another six supply wells, owned and operated by the City of Rahway, are located approximately four and one-half miles due west of the Site. The remaining five withdrawal points include four supply wells and one surface water source owned and operated by local industries. These sources provide non-potable water used in industrial operations.

At the Site, all potable water is provided by the Elizabethtown Water Company. Currently, no other water sources are used at the Site.

Exhibit L

6/14/72

39378

AGREEMENT FOR DISCHARGE INTO FLUME AND OUTFALL DITCH

AGREEMENT made this 24th day of August, 1972,

between

GAF CORPORATION, a Delaware corporation, having an office at 140 West 51st Street, New York, New York 10020 (herein called "GAF")

and

LINDEN CHLORINE PRODUCTS, INC., a Delaware corporation, having an office care of Shanley & Fisher, 570 Broad Street, Newark, New Jersey (herein called "LCP"):

RECEIVED & RECORDED UNION COUNTY, N.J.
AUG 25 9 34 AM '72
BOOK 2954 PAGE 340
REGISTER

WITNESSETH:

In consideration of the payment of One ($1.00) Dollar and other good and valuable consideration, LCP grants to GAF, the right to use a flume and outfall ditch located on LCP's property, in the City of Linden, Union County, New Jersey, as indicated on Exhibit D attached hereto, for the purpose of disposal of its waste-water effluent into the Arthur Kill.

The parties both understand that their respective wastewater effluents may both be discharged through the foregoing flume and outfall ditch, sometime referred to as South Branch Creek, into the Arthur Kill. Accordingly, each party shall be responsible for

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COUNTY OF UNION
CONSIDERATION None
REALTY TRANSFER FEE Exempt
DATE 8-25-72 BY

the type and characteristics of wastewater effluent, if any, so discharged by it, for obtaining the necessary permits to discharge into the Arthur Kill and for compliance with all applicable rules, regulations and orders for pollution control of any governmental authority, local, state or federal, having jurisdiction thereof.

LCP shall be responsible for the proper maintenance of the flume and outfall ditch. GAF agrees to reimburse LCP for seventy-five percent (75%) of said maintenance costs. Invoices for GAF's share of such maintenance costs shall be submitted at the end of each calendar quarter. Terms of payment shall be net thirty (30) days. LCP upon request of GAF agrees to permit an independent auditing firm acceptable to LCP, during usual business hours, to examine LCP's records pertaining to the costs for maintenance of said ditch.

GAF, at its option, may at any time discontinue the use of the flume and outfall ditch.

If LCP, at its expense, elects to fill all or part of said outfall ditch, LCP may, at its option, on one (1) years prior notice, terminate GAF's right to discharge wastewater effluent into said outfall ditch subject, however, to GAF obtaining necessary governmental and other approvals to construct at another location on its land another outfall ditch for the purpose of discharging wastewater effluent from the operation of its facilities. GAF shall have a similar right to elect to fill, at its expense, part or all of the said outfall ditch in which event GAF may in one (1) year notice require LCP to make arrangements for discharge of its wastewater effluent by pipeline or means other than discharge into the outfall ditch subject, however, to LCP obtaining necessary governmental or other approvals of such discharge by pipeline or other means. When GAF ceases discharging wastewater effluent into said outfall ditch its obligation to contribute to the maintenance thereof shall terminate.

If at any time either GAF or LCP is the only party using the outfall ditch such party shall bear one hundred (100%) percent of the cost of maintaining said ditch.

This Agreement shall inure to the benefit of and shall be binding upon GAF and LCP, their successors and assigns.

IN WITNESS WHEREOF, the parties hereto have set their hands and seals the day and year first above written.

GAF CORPORATION CORPORATE SEAL 1929 DELAWARE

GAF CORPORATION

ATTEST:

By [signature]

[signature]
Secretary

LINDEN CHLORINE PRODUCTS, INC. CORPORATE SEAL 1971 DELAWARE

LINDEN CHLORINE PRODUCTS, INC.

ATTEST:

By [signature]
President

WC Calvert Jr
Assistant Secretary

BK2954PG 342

STATE OF NEW YORK)
) ss.:
COUNTY OF NEW YORK)

BE IT REMEMBERED that on this 29 day of August in the year of our Lord one thousand nine hundred and seventy-two before me, the subscriber, a Notary Public of the State of New York personally appeared STANLEY B. FEUER who being duly sworn according to law upon his oath doth make proof to my satisfaction that he is and was at the date and execution of the foregoing instrument, the SECRETARY of GAF CORPORATION, one of the parties named in the foregoing instrument; that he knows the common seal of the said corporation, and that the seal thereto affixed is the common seal of the said corporation, and was the common seal of said corporation at the date and execution of the foregoing instrument; that the same was so affixed and the said instrument signed by THOMAS A. DENT who was at the date and execution thereof, a VICE PRESIDENT of the said corporation, in the presence of this deponent by authority of the Board of Directors of said corporation, and that he heard him acknowledge that he signed, sealed and delivered the said instrument as the voluntary act and deed of the said corporation, and that this deponent thereupon signed his name as an attesting witness.

Stanley B. Feuer

Stanley B. Feuer
Secretary

Sworn and subscribed before me,
the day and year above written.

Violet R. Roncace

Notary Public

VIOLET R. RONCACE
NOTARY PUBLIC State of New York
No. 03-4632830
Qualified in Bronx County
Certificate filed in New York County
Commission Expires March 30, 1974

BK2954PG 343

STATE OF NEW YORK)
) ss.:
COUNTY OF NEW YORK)

BE IT REMEMBERED that on this 24th day of August in the year of our Lord one thousand nine hundred and seventy-two before me, the subscriber, a Notary Public of the State of New York personally appeared WILLIAM C. CALVERT, JR. who being duly sworn according to law upon his oath doth make proof to my satisfaction that he is and was at the date and execution of the foregoing instrument, the ASSISTANT SECRETARY of LINDEN CHLORINE PRODUCTS, INC., one of the parties named in the foregoing instrument; that he knows the common seal of the said corporation, and that the seal thereto affixed is the common seal of the said corporation, and was the common seal of said corporation at the date and execution of the foregoing instrument; that the same was so affixed and the said instrument signed by C. A. HANSEN who was at the date and execution thereof, the PRESIDENT of the said corporation, in the presence of this deponent by authority of the Board of Directors of said corporation, and that he heard him acknowledge that he signed, sealed and delivered the said instrument as the voluntary act and deed of the said corporation, and that this deponent thereupon signed his name as an attesting witness.

W C Calvert, Jr.

William C. Calvert
Assistant Secretary

Sworn and subscribed before me,
the day and year above written.

Violet B. Roncace

Notary Public

VIOLET B. RONCACE
NOTARY PUBLIC, State of New York
No. 03-[illegible]
Qualified in [illegible] County
Certificate filed in New York County
Commission Expires March 30, 1974

This instrument prepared by
Edward S. Menapace
140 West 51st St.
New York, New York 10020

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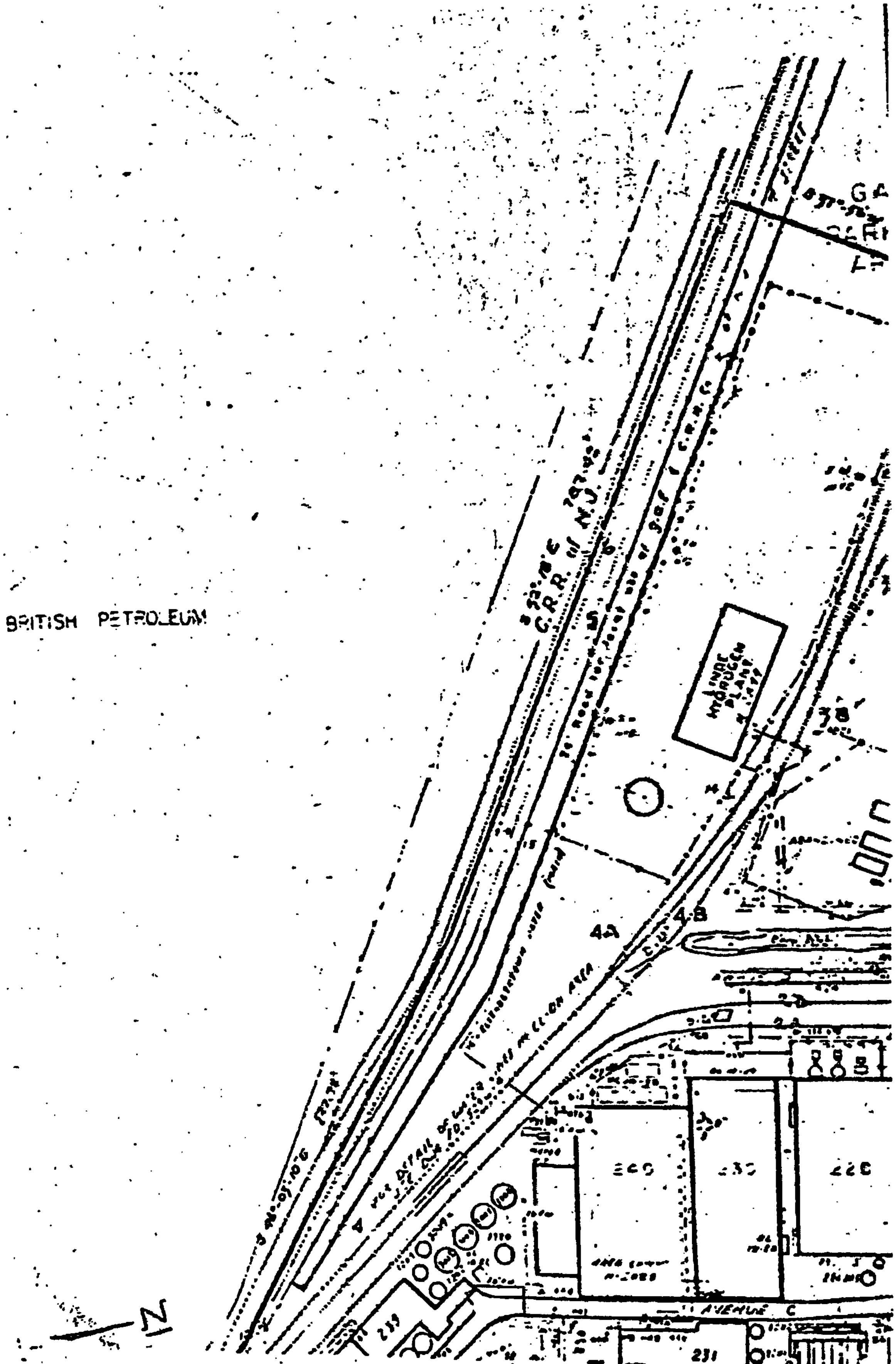

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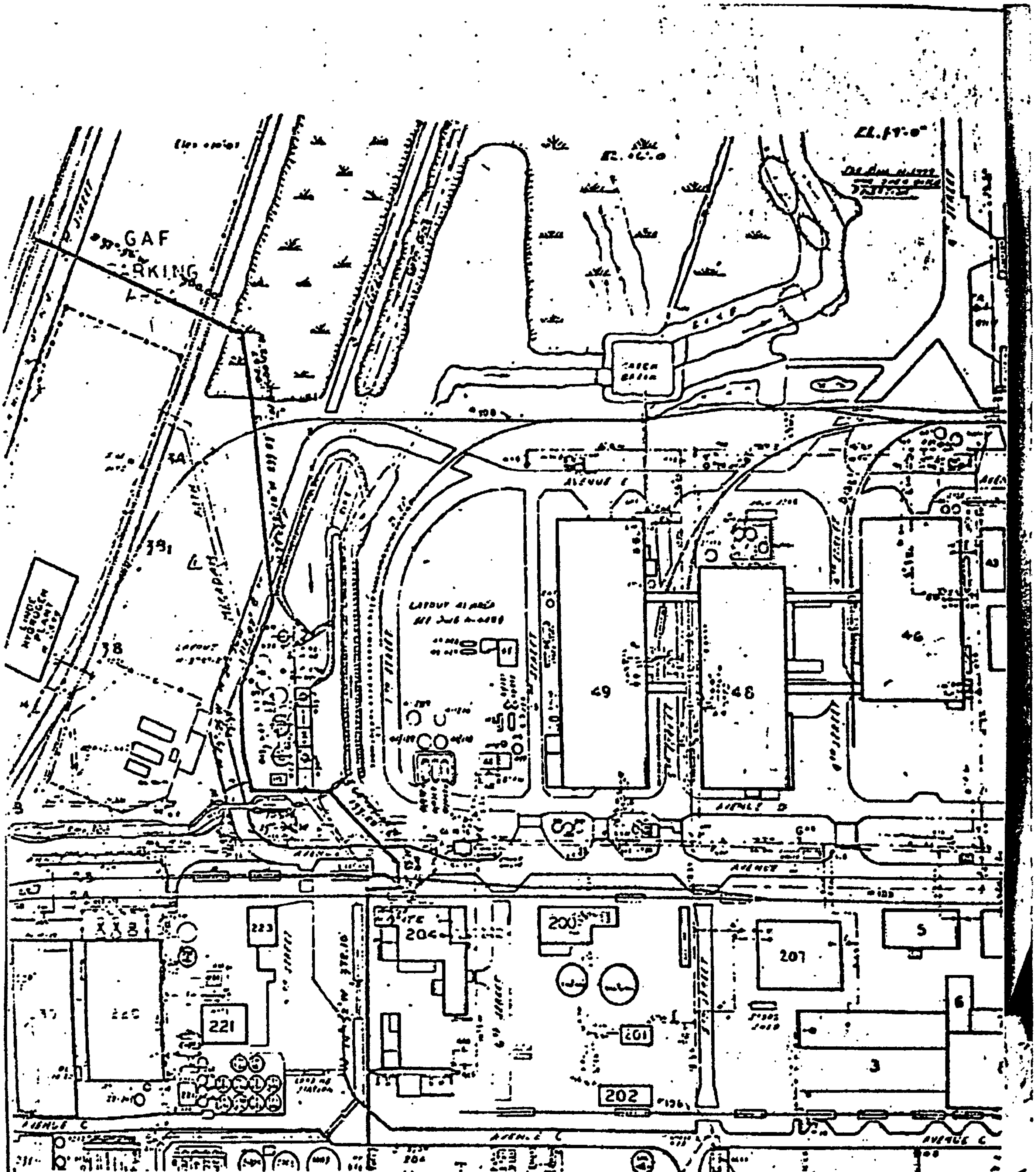

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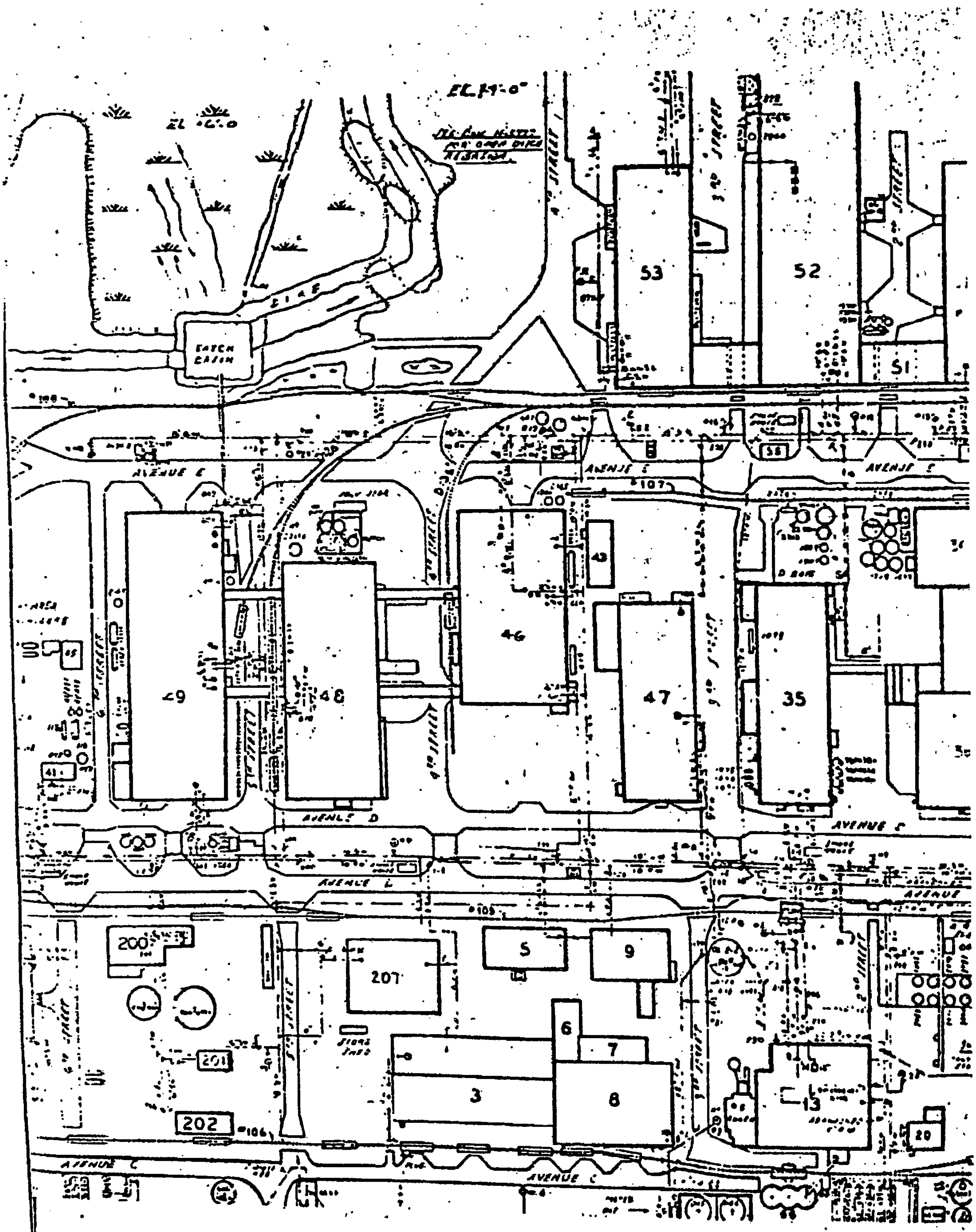
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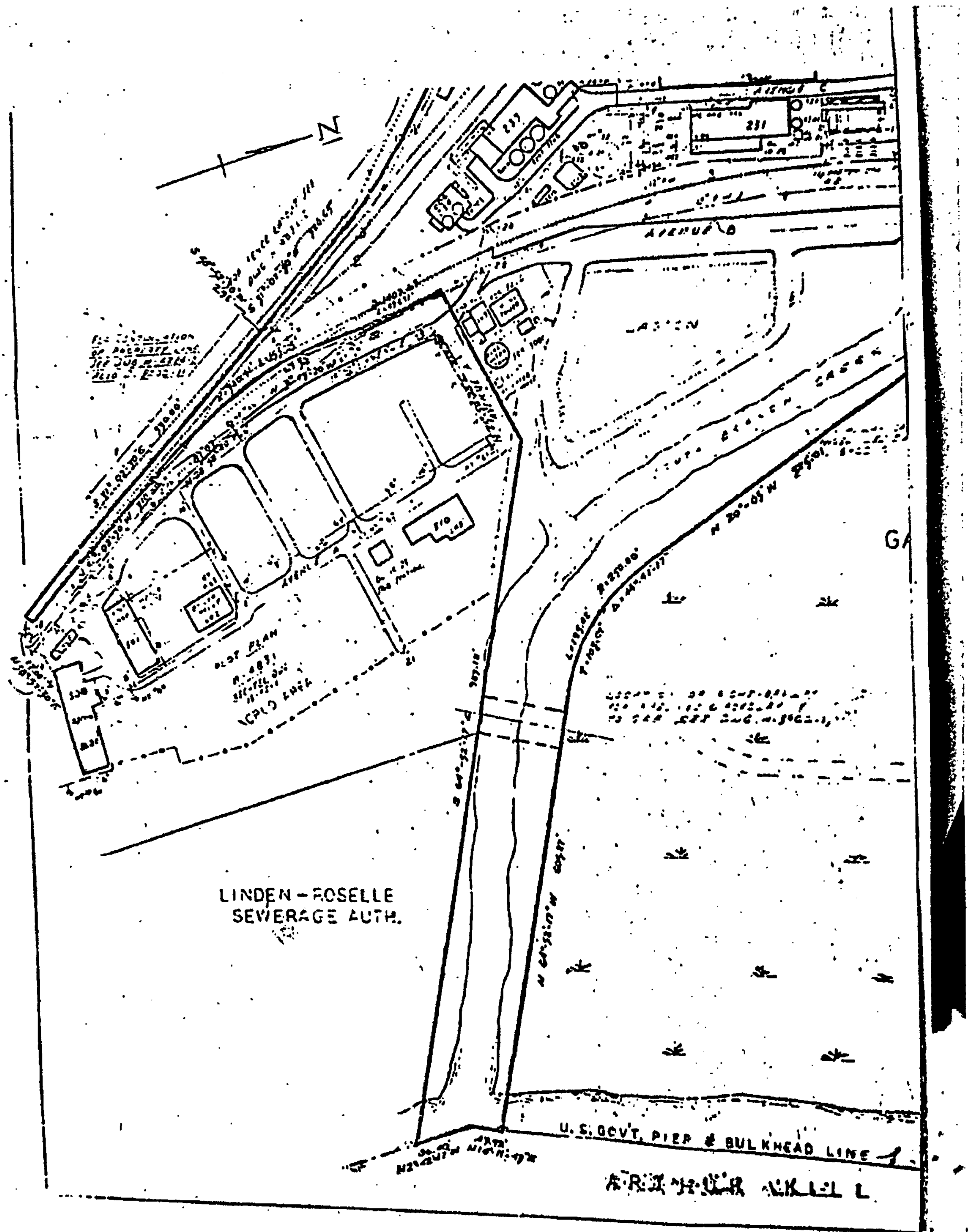
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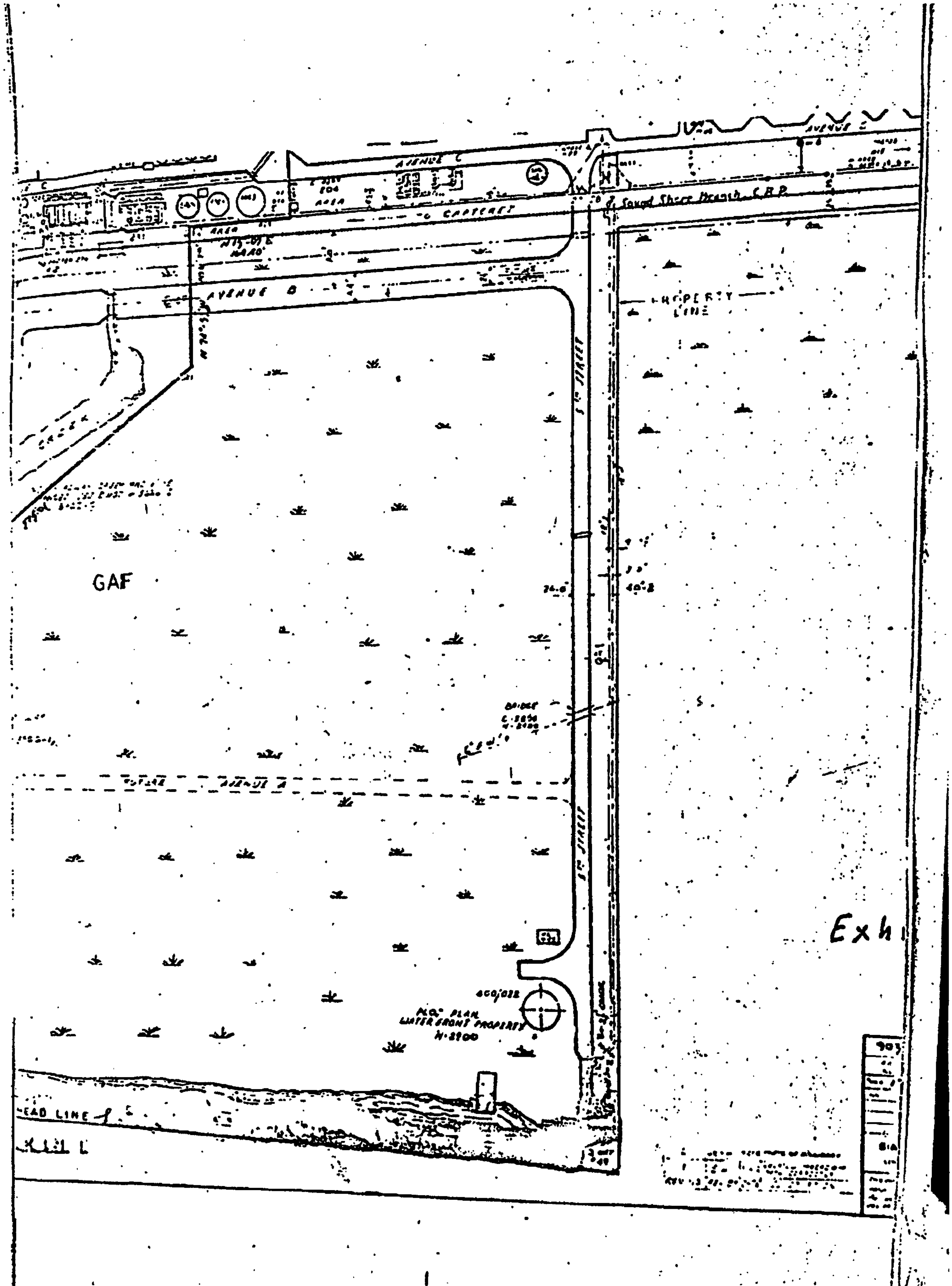

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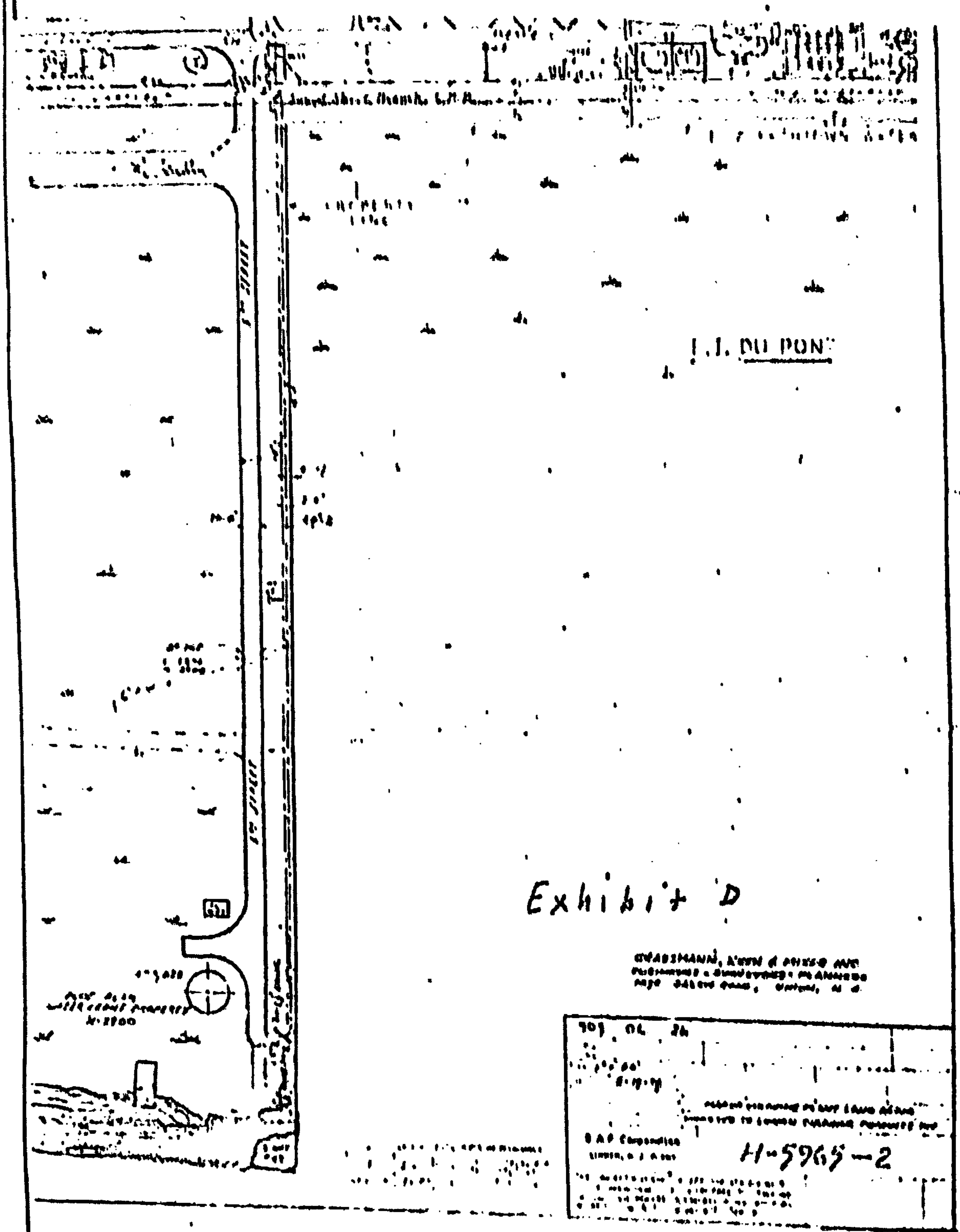

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END OF DOCUMENT

Exhibit M

Brown and Caldwell

Historic Drainage Analysis
LCP Chemicals Inc. Superfund Site
Linden, New Jersey

Revised October 2006
July 2004

HISTORIC DRAINAGE ANALYSIS
LCP CHEMICALS INC. SUPERFUND SITE
LINDEN, NEW JERSEY

Prepared for:

ISP Environmental Services Inc.
1361 Alps Road
Wayne, New Jersey 07470

Prepared by:

Brown and Caldwell
110 Commerce Drive
Allendale, New Jersey 07401

Revised October 2006
July 2004

127806.202

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12/10/2006

LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

1.0 INTRODUCTION

This report presents the results of an analysis of patterns of groundwater flow and historic surface drainage between the LCP Chemicals, Inc., Superfund Site (hereinafter referred as the LCP site) and the adjacent ISP-ESI site, located in Linden, New Jersey. This analysis has been conducted to evaluate whether or not the LCP site was historically connected to Piles Creek.

This document was originally submitted for agency review in July 2004. The October 2006 revision of the Historic Drainage Analysis report, contained herein, was modified in response to comments from Ms. Carole Petersen of USEPA dated February 6, 2006 as described in a letter to USEPA dated March 10, 2006. These modifications primarily include technical clarifications to the original document.

Piles Creek is a tidal creek located approximately 2,200 feet north of the LCP site. The area between the LCP site and Piles Creek is occupied by the ISP-ESI site. Piles Creek originates in the tidal marshlands located northwest of the LCP site, west of the New Jersey Turnpike and flows easterly into the Arthur Kill. In their letter dated March 12, 2003, USEPA, Region II, suggested that constituents from the LCP site might be present in surface waters and sediment on the ISP-ESI site property and from there have migrated to Piles Creek due to the possibility of a historical connection from LCP across the adjacent ISP-ESI site to Piles Creek.

The ISP-ESI property was developed for industrial production on filled tidal marshland starting in about 1919. The site was operated for chemical production under a variety of ownerships and names, the most recent being the former GAF Chemicals Corp (GAF) plant, which ceased operation in 1991. Industrial production at the former LCP facility, located immediately south of the ISP-ESI site, began much later in 1955 and continued until 1982.

Subsurface groundwater investigations at the LCP and ISP-ESI sites have revealed that groundwater flow patterns are substantially controlled by the surface water features in and around the site including the Arthur Kill, Piles Creek, and the on-site ditch system. As the dominant regional groundwater discharge feature, the Arthur Kill influences groundwater on the LCP site and the eastern portions of the ISP-ESI site to flow toward the Arthur Kill and away from Piles Creek, as shown on Figures 1-1 and 1-2.

A system of surface drainage channels historically existed on the ISP-ESI site that was used to convey cooling water, wastewater, and stormwater runoff to be treated prior to discharging into the Arthur Kill. From 1955 until about 1977, the drainage systems of the ISP-ESI site flowed through the LCP site to the Arthur Kill; during this time, the drainage from each site was interconnected.

The historic development of the surface drainage channels is shown on a series of maps, (Figures 1-5 through 1-9). These figures depict the historic locations of the drainage channels at the ISP-ESI and LCP sites within the context of the former industrial development at the sites. Figures 1-5 and 1-6 also depict the locations of the natural tidal channels that bordered Arthur Kill and Piles Creek prior to the filling of portions of the area for industrial development. Finally, the Arthur Kill and the various existing tidal creeks, including South Branch Creek and Piles Creek (located approximately 2,200 feet northwest of the LCP site on the far [north] side of the adjacent ISP-ESI site), are shown on Figure 1-6.

The physical character and location of surface water channels on the ISP-ESI and LCP sites, as well as the location of South Branch Creek, have been altered during the period of operation of industrial activities at the LCP site. The aerial photograph review, contained within, follows these alterations step by step and illustrates that, due to surface structures and dams, water flowing from the LCP site would have been confined to the southeast portion of the ISP-ESI Site and would not have traveled entirely across the ISP-ESI site to have made contact with Piles Creek.

The evaluation presented herein presents a discussion of groundwater flow and surface water flow patterns on the LCP and ISP-ESI sites. The surface water evaluation includes a study of 14 aerial photographs between April 20, 1951, and Spring 2002, as well as evidence from recent survey data on the construction of the culvert connecting the eastern and western portions of the ISP-ESI site. The selection of dates for the aerial photographs was chosen to overlap with the time period that gaseous chlorine was manufactured on the LCP site, between 1955 and 1982 in addition to photographic dates prior and subsequent to the operation of the plant.

1.1 GROUNDWATER FLOW

The geologic and hydrogeologic conditions beneath the LCP and ISP-ESI sites have been investigated in significant detail in subsurface investigations performed at each site. Data from these investigations are presented, respectively, in the documents titled "Site Characterization Summary Report, LCP Chemicals Superfund Site, Linden, New Jersey", (Brown and Caldwell, 2002) and "Remedial Investigation Report, ISP Environmental Services Inc. (ISP-ESI), GAF Chemicals Corporation Site, Linden, Jersey", (Eckenfelder Inc., 1991). In addition, a numerical groundwater flow model was developed using these data for the purpose of developing and evaluating the groundwater remediation system at the ISP-ESI Linden facility as presented in "Final Groundwater Flow Model Report for the ISP Linden Site", (Brown and Caldwell, 2002). The groundwater flow conditions beneath the LCP and ISP-ESI sites are described briefly below.

1.1.1 Geologic Conditions

The geology of the LCP and ISP-ESI sites consists of four principal units, as follows:

- An upper layer of man-made Fill,
- Marine Tidal-Marsh Deposits,
- Glacial Till, and
- Passaic formation bedrock.

Each of these units is described below:

Fill

A manmade layer of heterogeneous fill, placed in the tidal marshland to allow industrial development of the area, covers the vast majority of the site. Historically, most of the filling occurred during industrial expansion of the Site prior to 1960. The fill stratum extends laterally throughout most of the Site, ranging in thickness, where present, up to 16 feet, with an average thickness of approximately 9 feet. This unit primarily consists of an irregular mixture of soil, construction debris, and process wastes.

Marine Tidal Marsh Deposits

The fill is underlain throughout the plant site by marine tidal marsh deposits of Recent age. In general, these deposits consist of an upper layer of meadow mat and peat, gradationally underlain by an organic clay and silt. The marine tidal marsh deposits appear to be continuous across the site. Nevertheless, the Marine Tidal Marsh Deposits are likely locally penetrated by the construction of manmade drainage or "mosquito" ditches and the installation of piles and other manmade penetrations associated with the construction of former and existing facilities at the site. The organic clay and silt generally varies in thickness from 1.5 to 6 feet across the site, generally thickening toward the east.

Glacial Till

Underlying the marine tidal marsh deposits is a continuous layer of glacial till of Pleistocene age. Glacial till represents ground moraine deposits formed from the scouring and subsequent redeposition of the underlying Passaic formation by the glacial ice. This is evidenced by the similar red-brown color. The glacial till consists of a clayey and silty sand with minor amounts of gravel and cobbles.

Passaic Formation

The ISP-ESI site, and the region as a whole, is underlain by the Passaic formation of Jurassic age. The Passaic formation consists of moderately dipping beds of sandstone and shale. A thin layer of weathered rock, or saprolite, has been observed on the site. The top of competent rock ranges from 14 feet below mean level in the western portion of the site to 44 feet below mean sea level near the Arthur Kill. The Passaic formation is not a significant water supply aquifer in the immediate vicinity of the site due to brackish water conditions (there are no water supply, production or irrigation wells within a two mile radius of the site). Groundwater flow occurs primarily along fractures and, to a lesser extent, faults within the formation.

1.1.2 Groundwater Occurrence and Flow

Within the framework of the aforementioned geologic materials, three distinct hydrogeologic zones exist at the site, including:

- The uppermost water-bearing zone contained within the Fill and the peat subunit of the Tidal Marsh deposits, termed the "overburden water-bearing zone".

- An aquitard consisting of the organic silt & clay subunit of the Tidal Marsh Deposits (where present) and the Glacial Till.

- An aquifer contained within the upper portion of the Passaic Formation bedrock, termed the "bedrock water-bearing zone".

Overburden Water-Bearing Zone

The overburden water-bearing zone occurs predominantly within the fill material. The potentiometric surface of the overburden water-bearing zone (the water-table surface), is complex, being controlled largely by the ditches and other surface water bodies that exist throughout and around the sites. While the locations of the ditches have been changed over the years (Sections 1.2 and 2), the overall effect of these ditches on the pattern of groundwater flow is basically the same. That is, groundwater mounding occurs between the ditches as a result of infiltration of precipitation. Groundwater then flows laterally from the mounded areas to discharge to the ditches and other surface water bodies around the site.

The pattern of groundwater flow within the overburden water-bearing zone has been characterized by water table mapping performed for each in the aforementioned site investigation reports. Various water table contour maps and groundwater model simulations that define the water table configurations are presented in Figures 1-1, 1-2, and 1-3. These maps characterize groundwater and surface water flow patterns that were representative of the GAF site from 1966 until 2003. While groundwater elevation data are not available for the site prior to about 1987, characterization of groundwater flow conditions prior to this time has been made as follows:

- <u>1977 through 2003</u> - The flow directions upgradient of the LCP site were determined based on the GAF RI data surface water and groundwater flow data collected in 1990 and 2002, as above. These data are considered to be representative of the period from 1977 through 2003 given the fact that site drainage conditions were relatively unchanged during this period.

- <u>1966 through 1977</u> - The flow conditions in the western portion of the site were substantially unchanged from the conditions observed in 1990. Accordingly, the flow conditions during this period were based on a qualitative extrapolation of the 1990 data to the 1966 through 1977 period.

- <u>1955 through 1966</u> - The groundwater flow conditions in the western portion of the site are anticipated to be somewhat different than the period after 1966 given the changes in the surface drainage system, including the wastewater conveyance system, that occurred prior to 1966 (Section 2) and based on the demonstration that shallow groundwater is controlled at this site by the pattern of surface water flow.

Data obtained as part of the Phase I LCP RI (Figure 1-1) conclusively support the finding that shallow groundwater beneath the LCP Site flows easterly to the Arthur Kill. Specifically, shallow groundwater flow at the LCP site is controlled by the interaction of the shallow groundwater with the various drainage ditches, including South Branch Creek. Accordingly, groundwater from the southwestern portion of the LCP site flows toward and discharges to the ditch located south of the railroad tracks. In the northeastern portion of the LCP site the groundwater flows toward and discharges into the South Branch Creek. Each of these ditches flows to the Arthur Kill.

In summary, overburden groundwater beneath the LCP site does not flow toward Piles Creek. Furthermore, past groundwater flow patterns from the LCP site would also not have flowed toward Piles Creek given the historical patterns of surface water flow.

Bedrock Water-Bearing Zone

An aquifer exists within the competent bedrock of the Passaic formation. The Arthur Kill represents the dominant, regional discharge area for groundwater flow within the bedrock. Site-specific mapping of the bedrock piezometric surface (Figure 1-4) confirms the regional mapping (Anderson, 1968) in which bedrock groundwater flows to the east towards the Arthur Kill. This observed pattern of bedrock groundwater flow has been shown to be relatively unaffected by the shallow ditch systems at the site and is also confirmed by groundwater flow simulations using the numerical groundwater flow model. Furthermore, the LCP site is located immediately adjacent to the Arthur Kill while Piles Creek is nearly ½ mile distant in an upgradient direction from LCP. Accordingly, bedrock groundwater flow from the LCP site does not and would not historically have flowed toward Piles Creek.

1.2 SURFACE DRAINAGE SYSTEM

1.2.1 ISP-ESI Site Surface Drainage

As mentioned above, surface drainage channels that long predated LCP operations were constructed over much of the ISP-ESI site (Figures 1-5 and 1-6). The channel system was utilized by the former ISP-ESI manufacturing facility and its predecessors for the conveyance of stormwater runoff from the majority of the ISP-ESI site, cooling water and other wastewaters to the Arthur Kill and later to ISP-ESI's wastewater treatment plant (WWTP). The character of the channels was different in various areas of the ISP-ESI site.

The channels in the western half of the site were relatively wide and in some areas resembled ponds. The channels within the former manufacturing areas, in the eastern half of the ISP-ESI site, were narrower, and many were constructed with vertical, wooden sides. The discharges from the eastern channels were treated for several decades prior to the construction of the current WWTP, employing equalization, skimming, and lime neutralization prior to discharge to the Arthur Kill by way of South Branch Creek. This early treatment was performed in several different locations on the LCP and ISP-ESI sites. The channels continued to be used to convey the process water and stormwater flow to the current WWTP, constructed in 1977, which discharges directly to the Arthur Kill.

Prior to the start up of the current ISP-ESI WWTP, the channel system discharged to the Arthur Kill through either of two channels. Some portions of the margins ISP-ESI site continued to drain to small ditches not connected to the channel system. The northern of the two South Branch Creek channels, which corresponds to the original location of South Branch Creek (Figures 1-5, 1-6, and 1-7), was used for the longest period of time, up to approximately 1971. The southern channel, which is the current location of what is referred to as South Branch Creek (Figure 1-8), was used for a shorter time, from 1971 to 1977, when the current ISP-ESI WWTP was placed into operation. After 1977, the channel system continued to discharge to the currently existing WWTP on the ISP-ESI site (Figure 1-9).

1.2.2 LCP Site Drainage

Industrial process water and stormwater flow from the LCP site was historically connected to South Branch Creek via the ISP-ESI drainage channel system prior to its ultimate discharge to the Arthur Kill. This connection with the ISP-ESI drainage system was on the eastern side of the ISP-ESI site, just upstream of the discharge to the Arthur Kill. The drainage in and around the LCP site was modified several times, and is described as follows:

Prior to 1947

Prior to 1947, South Branch Creek flowed from the area located south of the ISP-ESI production area and flowed eastward across the center of what would later become the LCP site to discharge to the Arthur Kill (Figure 1-5). It should be noted that the tidal marshland drainage to South Branch Creek, which discharged to the Arthur Kill, was discrete and separate from the Piles Creek drainage.

1947 to 1951

Starting in 1947, South Branch Creek was diverted to an alignment that looped around the southern area of the future LCP production area prior to discharging to the Arthur Kill. Starting in the same year, filling of the portion of the creek in what would become the production area of the LCP site started to occur in preparation for industrial development of the site.

1951 to 1966

Construction of the southern loop realignment of South Branch Creek was completed by 1951, after which the LCP plant site was built (Figure 1-6). The LCP site started operations in 1955. The South Branch Creek channel continued to flow to the Arthur Kill from the southeastern portion of the ISP-ESI site, as described above, around the southern end of the LCP site, until 1966. During this time, water in South Branch Creek was treated in an area located immediately east of the electrical switchyard on the LCP site.

1966 to 1971

South Branch Creek was relocated by 1966 into a covered channel (or "flume") located along the northern border of the LCP site (Figure 1-7). The WWTP was apparently moved at this time to be located several hundred feet upstream of the covered channel to the ISP-ESI property.

The portion of South Branch Creek that previously looped around the southern side of the site was replaced by a continuous concrete drainage trench. This trench surrounding the process area was utilized after 1966 to collect storm water runoff and excess runoff from LCP Buildings 230 and 240. The flows in the trench were routed to a concrete sump south of Building 231 before being pumped to holding tanks outside Building 233. The water was pH adjusted, filtered, polished with carbon, and stored pending annual or semi-annual discharge to South Branch Creek.

After 1971

Around 1971, the South Branch Creek channel located east of the railroad tracks was relocated into a newly created, narrow man-made channel that discharged to the Arthur Kill approximately 950 feet south of the former South Branch Creek channel (Figures 1-8 and 1-9).

The process wastewater from the mercury cell buildings drained to concrete floor trenches where it was collected in the northwest corner of each building. The process wastewater was pumped to holding tanks and eventually pumped to the wastewater treatment plant on the ISP-ESI site. This wastewater treatment arrangement was used by LCP until the plant ceased operation in 1982.

The aforementioned arrangement of the LCP drainage system with regard to the ISP-ESI site supports the fact that Piles Creek should not have received runoff from the LCP site. This is demonstrated by the fact that, for the time period in question, the entire eastern portion of the ISP-ESI drained to the east by way of the LCP site. The LCP site drainage connected to this system just before the point where it discharged to the Arthur Kill. Therefore, for LCP drainage to flow to Piles Creek, it would have had to flow upstream a distance of nearly ½ mile across the ISP-ESI site.

Evidence is presented in Section 2.0 that reveals the lack of a physical connection from the drainage system in the eastern portion of the ISP-ESI site (to which LCP connected) over most, if not all, of the period that the LCP site was in operation. Therefore, even in the unlikely event that the ISP-ESI drainage system were to have temporarily reversed itself and flowed back across the site, it is extremely unlikely that LCP drainage could have flowed all the way to Piles Creek. This is due to the fact that LCP is located at the foot of the surface drainage system on the edge of the Arthur Kill while Piles Creek is located nearly ½ mile distant in an upstream direction of LCP.

2.0 AERIAL PHOTOGRAPHIC ANAYSIS

In this section, an analysis of a selection of many high-resolution photographs is presented. These include both high-altitude and low-altitude photographs that are available for the LCP and ISP-ESI Linden sites, located within the Grasselli Point area of Linden, New Jersey. These aerial photographs were purchased from a number of commercial aerial photography sources.

The methodology utilized to prepare this aerial photogrammetric interpretation included the following steps:

- Obtained and digitized aerial photographs at high resolution.

- Imported the scanned images into the Geographic Information System (GIS) for the site by georeferencing the photos to the New Jersey State Plane coordinate system.

- Overlaid geographic data (e.g., property lines) over the photographs.

- Displayed the photographs at two different map scales for subsequent analysis.

- Analyzed aerial photographs.

- Annotated digitized aerial photographs.

The analysis methods and annotation format presented is similar to those presented in the aerial photographic analysis prepared by EPA for the LCP site (USEPA, March 1999). The narrative provided below describes the results of the aerial photographic interpretation, including annotations to identify objects and features observed on the aerial photographs.

Each of the photographs is shown in two views. The first is a close-up view of the northwestern section of the ISP-ESI site at a scale of 1" = 200 ft. The second is a larger view (1" = 400 ft) that also shows the area from the LCP site northward to Piles Creek. Each of the key features that are annotated on the close-up view is also annotated on the corresponding large view.

APRIL 20, 1951, PHOTOGRAPH

Close-up View (Figure 2-1)

Prior to the development of the LCP site, the western marsh area of the ISP-ESI Linden facility is undeveloped, as of 1951. The area consists largely of unfilled tidal marshlands into which "mosquito" (drainage) ditches have been excavated. The tidal marshland is connected to Piles Creek through a channel that extends beneath a bridge along Grasselli Road. Hydraulic separation between channel C1 and tidal creek channel TC1 is inconclusive due to the presence of an unknown structure separating the two water bodies as of this date. Channel C1 is separated into northern and southern portions by a culvert.

Large View (Figure 2-2)

Each of the features, described above, on the close-up view is depicted on the large view map on Figure 2-2.

As shown in the large-view photograph, the location of South Branch Creek is observed in the southeast corner of the ISP-ESI site where it flows across the center of the future LCP site. South Branch Creek connects and discharges to the Arthur Kill at a point on the ISP-ESI site, located approximately 750 feet north of the current discharge point. A box culvert (CT) is under construction along the southern loop of South Branch Creek.

Construction of the LCP facility has not started. However, the loop of South Branch Creek around the southern side of what would become the LCP facility is evident.

APRIL 20, 1954, PHOTOGRAPH

Close-up View (Figure 2-3)

In 1954, the western marsh area of the ISP-ESI Linden facility remains undeveloped. After April 20, 1951 (refer to Figures 1-5, 1-6, and 1-7), the fill area (FL) located between channel C1 and tidal creek channel TC1 has expanded to completely separate channel C1 and tidal creek channel TC1. Therefore, channel C1 was hydraulically separated from tidal creek channel TC1 and Piles Creek and the unknown structure is unquestionably gone. This hydraulic separation is significant, as this eliminates a potential hydraulic connection between the LCP site and Piles Creek prior to the construction and operation of the LCP site.

Large View (Figure 2-4)

Each of the features described above on the close-up view is depicted on the large-view map on Figure 2-4.

At the southern-most point of channel C1, the channel meanders southeast across the southeast portion of the ISP-ESI site, connecting channel C1 on the ISP-ESI site to South Branch Creek at its original location. Channel C1 flows across the ISP-ESI site to South Branch Creek on the ISP-ESI site, located approximately 750 feet north of the current discharge point. The box culvert (CT) along the southern loop of South Branch Creek is still visible.

Construction of the LCP facility has commenced.

MAY 16, 1954, PHOTOGRAPH

Close-up View (Figure 2-5)

There are no noticeable differences since April 20, 1954 (Figure 2-3).

Large View (Figure 2-6)

Each of the features described above on the close-up view is depicted on the large-view map on Figure 2-6.

NOTE: Two dark straight lines that intersect on the eastern portion of the site are not believed to be related to site features (i.e., an artefact on the photograph).

NOVEMBER 20, 1958, PHOTOGRAPH

Close-up View (Figure 2-7)

After May 16, 1954 (refer to Figure 2-5), the Ethylene Oxide Plant (EOP) and Building 120 (B120) have been constructed in the western marsh area of the ISP-ESI Linden facility. Additionally, an east-west road (R1) has been constructed connecting the EOP to the manufacturing area located in the eastern portion of the facility. Road R1 intersects a newly constructed road (R2) running in a north-south direction, west of channel C1. The western marsh has been divided into northern and southern cells by road R1 (4th Street), R1 effectively provides hydraulic separation between the northern and southern cells, preventing the flow of water from the southern cell to Piles Creek.

Channel C1 contains a fill area (FL) that has even more completely separated the north and south sections of channel C1 and partially fills in the north portion of channel C1.

The fill area (FL) located between channel C1 and tidal creek channel TC1 has expanded during the time interval following May 16, 1954 (Figure 2-5), to partially fill tidal creek channel TC1. The previously observed (April 20, 1951 and May 16, 1954) eastern portion of tidal creek channel TC1 has been filled and Building 120 (B120) has been constructed in this area (refer to Figures 1-5 to 1-9). There continues to be no connection between channel C1 and tidal creek channel TC1 and hence Piles Creek.

The previously observed (April 20, 1951 and May 16, 1954) tidal creek channels TC2, TC3, and TC4 were filled either partially or completely to enable construction of the EOP at this location.

Mosquito ditch (MD1) has been split into north and south sections as a result of the construction of road R1. Additionally, the northern portion of mosquito ditch MD1 has been filled to enable construction of Building 120 (B120).

It is possible that after the road to the ethylene oxide plant (R1) was built, the presence of ponding south of R1 led to the construction of culvert CT3 (Figure 2-7) west of the southern portion of channel C1 to connect the western marsh area to the eastern manufacturing facility in an attempt to allow the standing water to drain to channel C1. This culvert is evidenced by the apparent presence of inlet/outlet channels on each end of the culvert. According to an available survey drawing, the invert elevations for culvert CT3 under the access road were +2.74 ft. at the west end and +2.63 ft. at the east end, indicating that by design and installation, the intended flow direction at the time this pipe was installed was from west to east. The presence of culvert CT3 has no bearing during this period regarding a hydraulic connection from channel C1 to Piles creek as the elevated road (R1) acts as a berm to prevent the flow of water northward to Piles Creek.

Standing water (SW) is visible in the southern cell of the western marsh, indicating that water is being impounded and does not flow through culvert CT3. This could be because culvert CT3 does not in fact exist as of this date. Alternatively, the water level in the southern cell of the marsh may be maintained by relatively high heads in channel C1. Two fill areas (FL) are located near the standing water (SW) within the southern cell.

While the LCP site is likely to be hydraulically connected to channel C1, channel C1 is clearly located hydraulically upgradient of the LCP site in the center of the ISP-ESI site. This conclusion is established on the basis of the configuration of the drainage channel that carries process water and stormwater from the former production area on the ISP-ESI site to the east to Arthur Kill, as shown on Figure 2-8. Additionally, these findings are consistent with the topographic data that were obtained later as part of the RI in 1990.

Large View (Figure 2-8)

Each of the features described above on the close-up view is depicted on the large view map on Figure 2-8.

The southern portion of channel C1 that meanders southeast has been separated into two sections by a fill area (FL), although the two sections have been connected with a culvert (CT4). A fill area (FL) has been added along South Branch Creek on the LCP site where a portion of South Branch Creek has been rerouted below ground. The box culvert (CT) along the southern loop of South Branch Creek is still visible.

Construction activities have continued on the LCP facility with the addition of other buildings, storage tanks, and the electrical switchyard.

APRIL 3, 1959, PHOTOGRAPH

Close-up View (Figure 2-9)

The standing water (SW) visible on November 20, 1958 (refer to Figure 2-7), in the southern cell of the western marsh has expanded, thereby indicating water cannot drain from the southern cell. This flow blockage is likely due to the non-existence of the culvert (CT3) connecting the western marsh area to the eastern manufacturing facility and/or the elevated head in channel C1.

The standing water (SW) observed on November 20, 1958, in the northern portion of channel C1 is absent.

Large View (Figure 2-10)

Each of the features described above on the close-up view is depicted on the large view map on Figure 2-10.

There are no noticeable differences in the LCP facility, channel C1, and South Branch Creek on the LCP site since November 20, 1958 (Figure 2-8).

APRIL 23, 1961, PHOTOGRAPH

Close-up View (Figure 2-11)

The standing water (SW) visible in the south-western portion of the site has expanded subsequent to April 3, 1959, indicating that water still cannot drain from the southern cell. There continues to be no connection between the northern and southern cells of the western marsh area due to road R1, indicating that there is no flow of water between the southern cell and Piles Creek. The two fill areas (FL) located near the standing water have expanded following April 3, 1959.

The standing water (SW) that was absent from the northern portion of channel C1 in April 3, 1959 (Figure 2-9), is again visible.

Large View (Figure 2-12)

Each of the features, described above on the close-up view is depicted on the large view map on Figure 2-12.

There are no noticeable differences in the LCP facility, channel C1, and South Branch Creek on the LCP site since April 3, 1959 (Figure 2-10).

DECEMBER 4, 1966, PHOTOGRAPH

Close-up View (Figure 2-13)

After April 23, 1961, a fill area (FL) located near Piles Creek was added in an east-west direction across the northern portion of the tidal creek channels in preparation for construction of a dam separating tidal creek channels from Piles Creek. Tidal creek channels TC1, TC2, and TC3 are observed to contain more water than was previously observed which may be caused by a constriction of tidal flows from Piles Creek resulting from the addition of the fill.

The marsh area south of road R1 has been nearly completely filled in (FL). A bridge (BR) has been constructed beneath road R1, connecting the northern and southern cells of the western marsh. The bridge (BR) provides hydraulic communication between the southern and northern cells of the western marsh which may have been required to accommodate the water that has apparently backed up from the placement of fill (FL) in preparation for the construction of a dam.

The fill area (FL) located near the standing water observed on April 23, 1961, has expanded to almost completely fill this area. The standing water (SW) observed in the southern cell of the western marsh on April 23, 1961 (refer to Figure 2-10) is largely absent.

Overhead power lines (OPL) were constructed in this fill area (FL).

After April 23, 1961, the northern portion of channel C1 received fill (FL) to partially backfill the channel.

Large View (Figure 2-14)

Each of the features described above on the close-up view is depicted on the large view map on Figure 2-14.

A fill area (FL) has been added to the portion of the South Branch Creek located on the LCP manufacturing portion of the property. Additional fill has been added along the South Branch Creek on the LCP site where more of South Branch Creek has been rerouted into a covered channel. The box culvert (CT) visible along the southern loop of South Branch Creek in 1961 has been completed and covered. A system of wooden flumes and concrete trenches have been added to connect South Branch Creek between Avenue B and

Avenue C, which extend northward along Avenue C, then extend westward along the northern boundary of the site across Avenue D and connect into the ditch system of the ISP-ESI site. The portion of the South Branch Creek remaining above ground is located east of the manufacturing area of LCP. Some of the standing water (SW) observed on April 23, 1961, in the southern section of channel C1 that meanders southeast is absent. A fill area (FL) has been added to the eastern-most portion of the southern section of channel C1.

Additional construction activities have occurred on the LCP facility since April 23, 1961.

APRIL 11, 1967, PHOTOGRAPH

Close-up View (Figure 2-15)

The high water levels in tidal creek channels TC1, TC2, and TC3 continue to be visible which are likely caused by a constriction of tidal flows from Piles Creek caused by the addition of fill (FL) in preparation for the construction of a dam separating the tidal channels from Piles Creek.

The standing water (SW) observed on December 4, 1966 (refer to Figure 2-13), in the southern portion of channel C1 is absent in some areas of the channel.

Large View (Figure 2-16)

Each of the features described above on the close-up view is depicted on the large view map on Figure 2-16.

There are no noticeable differences in the LCP facility, channel C1, and South Branch Creek on the LCP site since December 4, 1966 (Figure 2-14).

APRIL 16, 1968, PHOTOGRAPH

Close-up View (Figure 2-17)

After April 11, 1967 (refer to Figure 2-14), the construction of a dam has been completed between the tidal creek channels and Piles Creek. As a result of the dam, standing water (SW) is visible in the northern area of the marsh, indicating that this area no longer drains to the north to Piles Creek. In fact, the northern cell of the marsh has been completely flooded, eliminating the tidal creek channels previously visible. Water from these areas likely flows through culvert CT3 into channel C1.

A fill area (FL) is located in the northern cell north of road R1.

Standing water (SW) is visible in the southern cell of the marsh along a channel.

The standing water (SW) that was absent from the southern portion of channel C1 on April 11, 1967, is again visible.

Large View (Figure 2-18)

Each of the features described above on the close-up view is depicted on the large view map on Figure 2-18.

The standing water (SW) that was absent from the southern portion of channel C1 on April 11, 1967, is again visible.

There are no noticeable differences in the LCP facility and South Branch Creek on the LCP site since April 11, 1967 (Figure 2-16).

APRIL 9, 1977, PHOTOGRAPH

Close-up View (Figure 2-19)

The presence of the dam continues to provide hydraulic separation between the ISP-ESI site and Piles Creek. After April 16, 1968 (refer to Figure 2-17), the fill area (FL) in the northern marsh has expanded. Evidence of impounded water in the western marsh indicates that water does not flow from the southern and northern cells of the western marsh to Piles Creek due to the presence of the dam. Water apparently flows from the western marsh area east through culvert CT3 to channel C1.

Standing water (SW) is visible east of channel C1.

Large View (Figure 2-20)

Each of the features described above on the close-up view is depicted on the large view map on Figure 2-20.

The previous course of South Branch Creek from Avenue B to the Arthur Kill was altered between April 16, 1968, and 1972 to allow the construction of the ISP-ESI WWTP at its present location. Accordingly, the portion of South Branch Creek east of the railroad tracks is now a narrow channel that discharged to the Arthur Kill on the LCP site, located approximately 950 feet south of the former South Branch Creek channel.

There are no noticeable differences in the LCP facility since April 16, 1968 (Figure 2-18).

DECEMBER 22, 1978, PHOTOGRAPH

Close-up View (Figure 2-21)

There are no noticeable differences since April 9, 1977 (refer to Figure 2-19). Impounded water in the western marsh indicates that there is no flow from the southern and northern cells of the western marsh to Piles Creek due to the presence of the dam. Water from the western marsh area flows east through culvert CT3 to channel C1.

Large View (Figure 2-22)

Each of the features described above on the close-up view is depicted on the large view map on Figure 2-22.

There are no noticeable differences in the LCP facility, channel C1, and South Branch Creek on the LCP site since April 9, 1977 (Figure 2-20). However, the present WWTP plant consisting of the three large lagoons is now operational which means that South Branch Creek is no longer used as a waste water discharge.

NOVEMBER 15, 1988, 1995, AND SPRING 2002 PHOTOGRAPHS

Close-up View (Figures 2-23, 2-25, 2-27)

There are no noticeable differences since December 22, 1978 (refer to Figure 2-21). Impounded water in the western marsh indicates that there is no flow from the southern and northern cells of the western marsh to Piles Creek due to the presence of the dam. Water from the western marsh area flows east through culvert CT3 to channel C1.

Large View (Figures 2-24, 2-26, 2-28)

Each of the features described above on the close-up view is depicted on the large view map on Figures 2-24, 2-26, and 2-28.

There are no noticeable differences in the LCP facility, channel C1, and South Branch Creek on the LCP site since December 22, April 9, 1977 (Figure 2-22).

3.0 SUMMARY

An evaluation of available data reveals that groundwater and surface water from the LCP site would not have flowed historically from the LCP site to Piles Creek. The conclusions regarding the patterns of groundwater flow are based on site-specific groundwater investigations and associated numeric groundwater flow modeling in which groundwater in the area of the LCP site is shown to flow eastward toward the Arthur Kill. Notwithstanding the fact that surface drainage from the LCP site was connected to the ISP-ESI ditch system, the data show that it was for the function of letting the ISP-ESI ditch system flow through the LCP site (and not vise versa) that surface drainage from the LCP site would not have flowed across the ISP-ESI site to Piles Creek. Both groundwater and surface water from the LCP site would have followed current flow patterns and would have flowed historically to the Arthur Kill.

The site surface drainage history was performed using available aerial photographs and other site data. The data reveal that drainage would not have flowed from the LCP site to Piles Creek. While the LCP drainage system was physically connected to the ISP-ESI drainage channel system, the LCP site was on the downstream end of the system. Therefore, water from the ISP-ESI site flowed through the LCP site to discharge to the Arthur Kill. Furthermore, the portion of the ISP-ESI drainage channel system to which LCP was connected was hydraulically separated from Piles Creek for most, if not all, of the period that the LCP site was in operation. Therefore, waste materials from LCP site would not have flowed to or discharged to Piles Creek.

The ISP-ESI and LCP sites utilized an interconnected system of surface channels to convey cooling water, wastewater, and stormwater runoff. This water was treated and then discharged to the Arthur Kill, via South Branch Creek, from 1955 until 1977, when the new ISP-ESI WWTP started operation. Four (4) different alignments of South Branch Creek have flowed from the ISP-ESI site and through the LCP site to discharge to the Arthur Kill:

- Natural tidal channel prior to filling and development of the site (Figure 1-5).

- Man-made alignment looping to the south around the future LCP site from 1951 to 1966 (Figure 1-6).

- Man-made alignment, after 1966, into a covered channel (flume) replacing the southern loop around the LCP site (Figure 1-7).

- Creation of a new, man-made channel discharge to Arthur Kill 950 feet south of the former South Branch Creek channel (1966 to present).

Due to its proximity with the Arthur Kill, the LCP connection to the ISP-ESI channel system (South Branch Creek) was located a relatively short distance upstream of the discharge to the Arthur Kill. Therefore, while the systems were interconnected, flow from the LCP site would not have flowed upstream and backwards through the WWTPs over the ISP-ESI site to Piles Creek.

In addition to the flow patterns described above, the drainage channel system in the eastern half of the ISP-ESI site, which was the portion connected to the LCP site, was hydraulically separated from Piles Creek for the entire period that the LCP site was in operation. A possible exception to this statement is a brief period from about 1966 to 1968, after construction and filling activities began to eliminate hydraulic connection to Piles Creek prior to final completion of the dam. Even so, the surface water drainage patterns indicate that surface water originating from LCP would not have flowed upstream across the ISP-ESI site. At other times between 1955 and the present, separation was afforded by the lack of a hydraulic connection between the various site drainage channels. (Figures 1-5 through 1-9) The hydraulic separation between the eastern and western portions of the site was progressively eliminated by the construction of a bridge and culvert in around 1961 and 1966 or 1968, respectively. However, a dam was constructed in 1968 that provided a positive separation between the ISP-ESI drainage channel system and Piles Creek.

It should be noted, that the aforementioned Bridge is located nearly ½ mile upstream of the LCP site. Surface water from the LCP site drained eastward to the Arthur Kill not toward the upstream Bridge. The existence of the Bridge is only mentioned because, for all other years of LCP operation, there was a confirmed dam, berm and/or topographical barrier located upstream of the LCP Site. However, even without upgradient topographical obstructions, the surface water, shallow groundwater and deep groundwater beneath LCP all flowed directly to the Arthur Kill. LCP is located on the shoreline of the Arthur Kill and the Arthur Kill is the dominant region groundwater and surface water discharge point. Given that the groundwater and surface water flow from LCP was to the Arthur Kill, water would not migrate upgradient through the drainage system nearly ½ mile to Piles Creek, even in the absence of a physical upgradient barrier.

Industrial activities at the LCP site began in 1955, at which point water flowed to South Branch Creek and onward to the Arthur Kill. The ISP-ESI drainage system connected to South Branch Creek upstream of the LCP site, as described above. Later, the orientation of South Branch Creek on the LCP site was significantly modified where it was relocated by 1966 into a covered channel (or "flume"). At the same time, the discharge of South Branch Creek to the Arthur Kill was relocated 950 feet to a point on the LCP site. Water collection on the LCP site was apparently modified at this time; the portion of South Branch Creek that previously looped around the southern side of the process area was replaced by a continuous concrete drainage trench. This trench directed stormwater to a treatment area prior to discharge to South Branch Creek. Around the same time, process water handling was also modified in which this water was collected and pumped to the ISP-ESI treatment plant. This wastewater treatment arrangement was used by LCP until the plant ceased operation in 1982.

Figures

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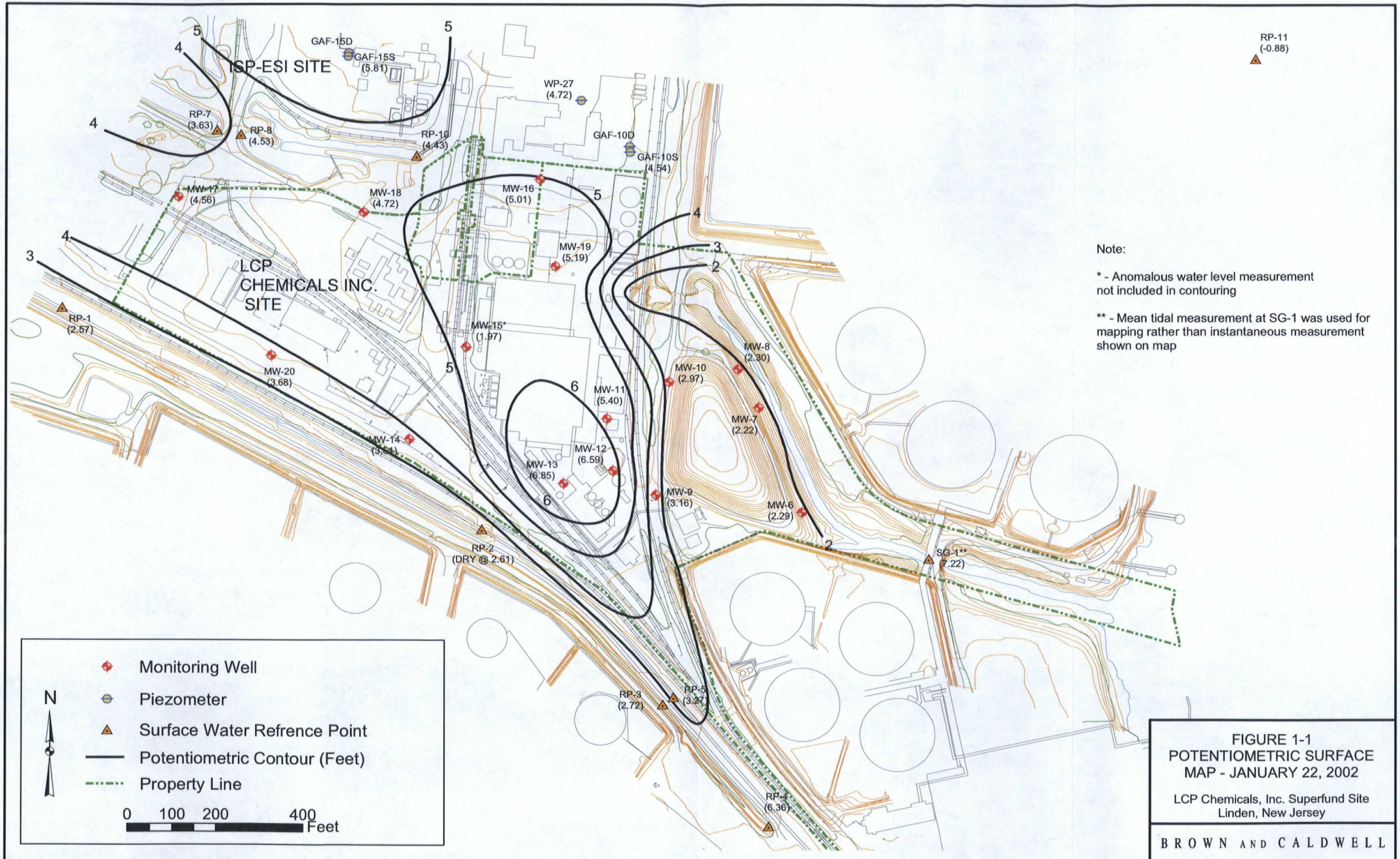

Note:

* - Anomalous water level measurement not included in contouring

** - Mean tidal measurement at SG-1 was used for mapping rather than instantaneous measurement shown on map

FIGURE 1-1
POTENTIOMETRIC SURFACE MAP - JANUARY 22, 2002

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

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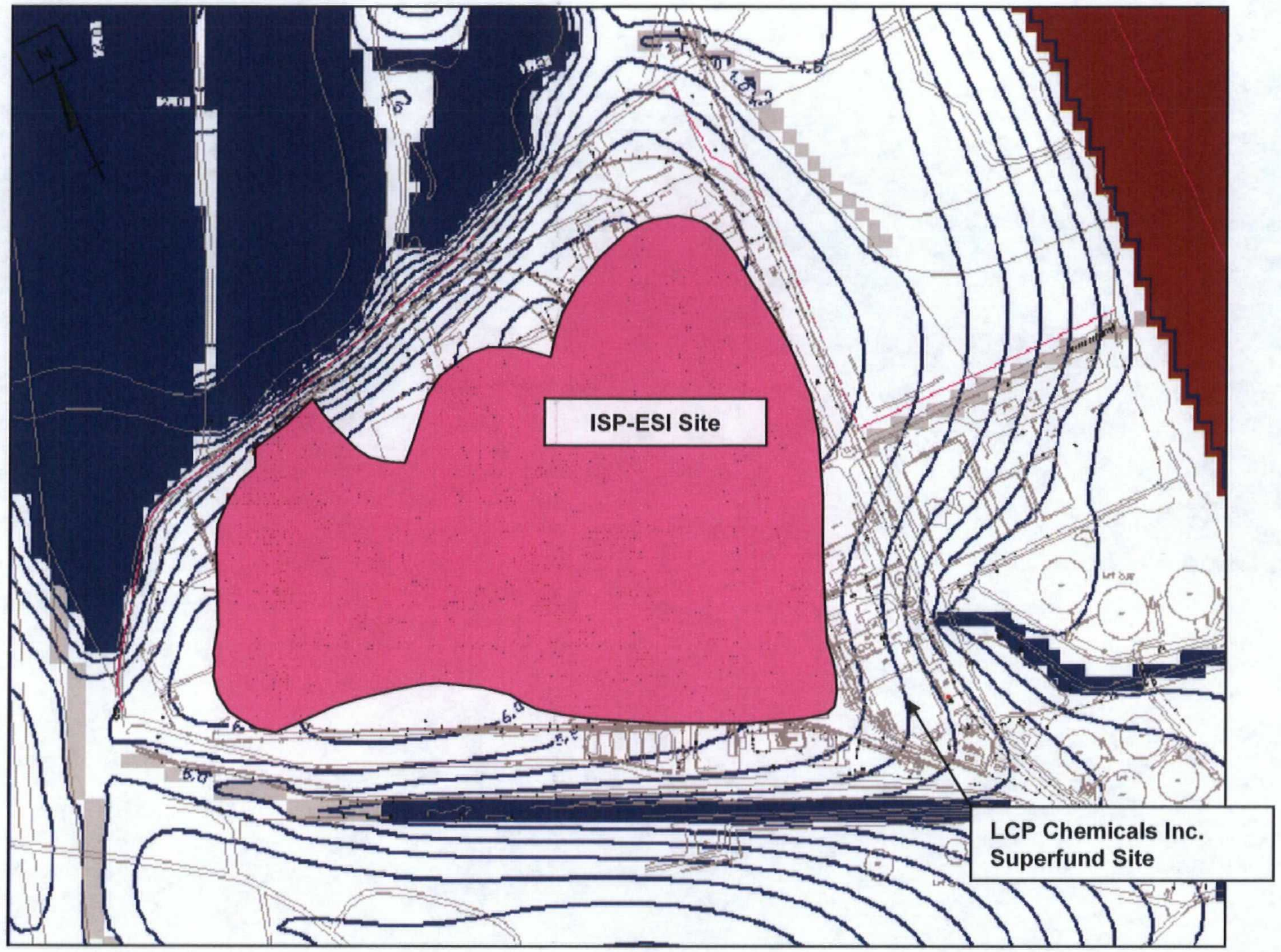
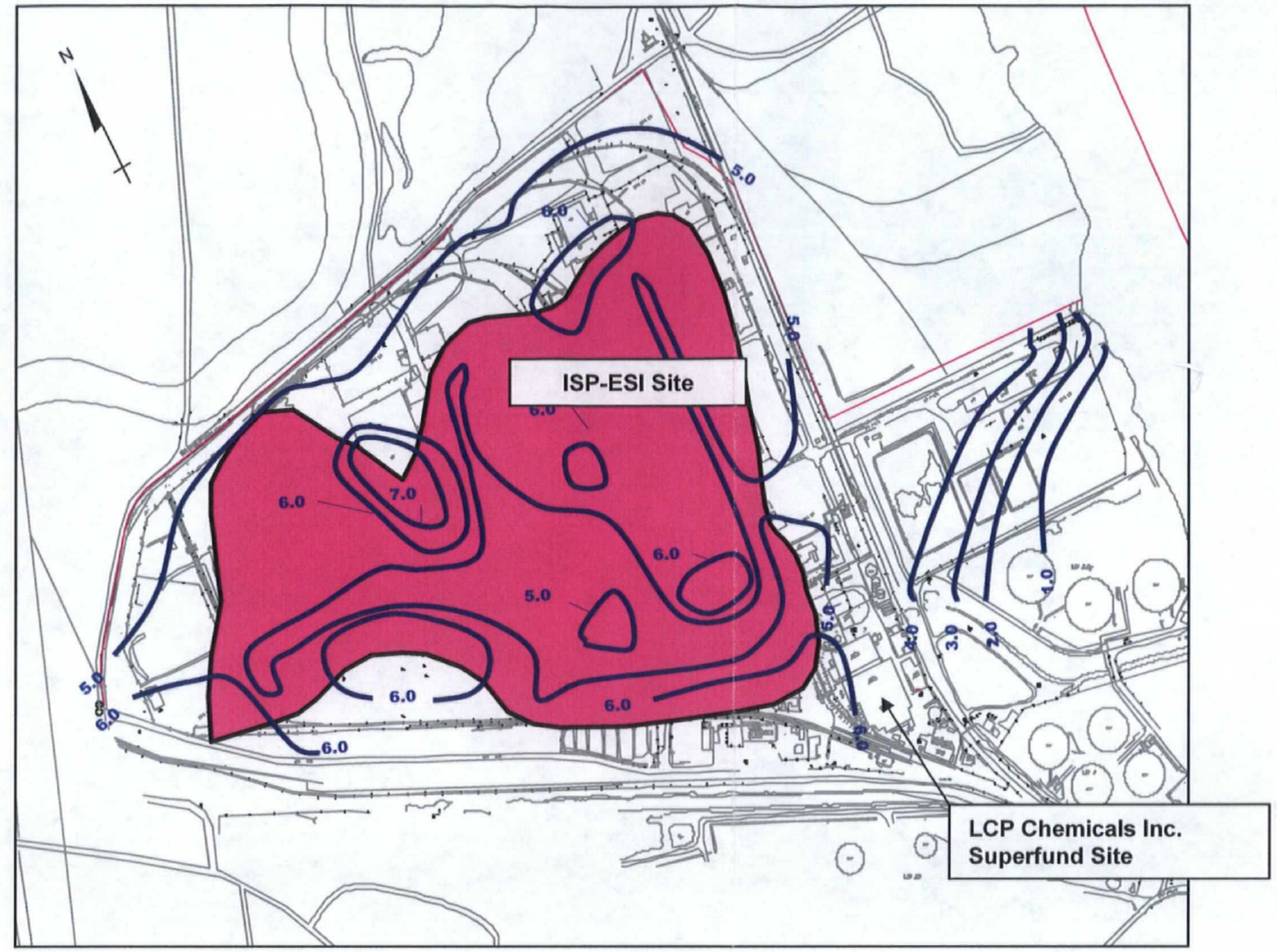
22241.150



Computer-Predicted Conditions



Observed Conditions

LEGEND

- River Cells
- Constant Head Cells
- Drain Cells
- Ditch System Capture Zone
- Computed Groundwater Contours in Feet

Map Source:

"Groundwater Flow Model Report for the ISP Linden Site", (Brown and Caldwell, 2002)

LEGEND

- Ditch System Capture Zone
- Measured Groundwater Contours (11-19-90) in Feet

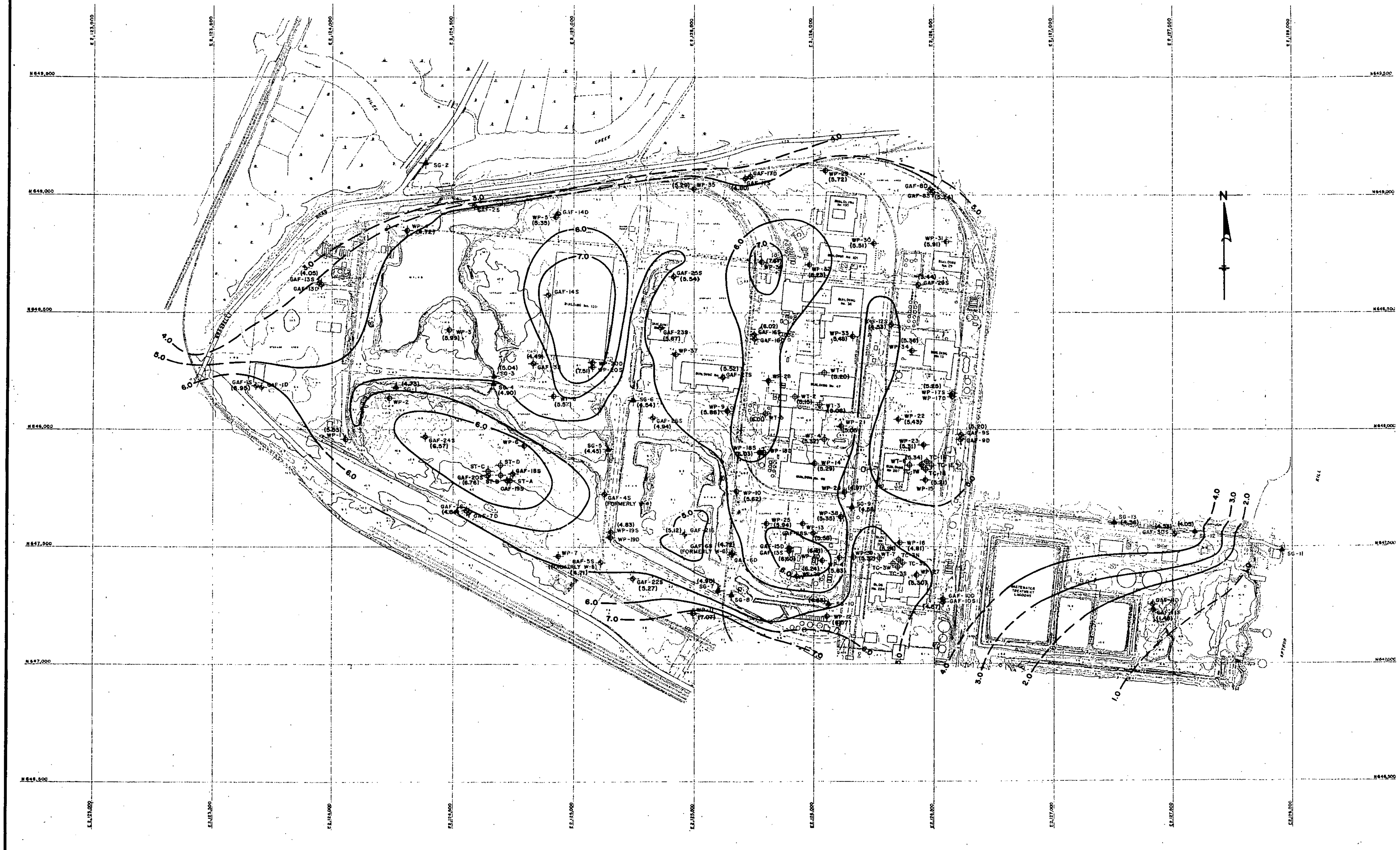
FIGURE 1-2

Comparison of Observed and Computer-Predicted Ditch System Capture Zones

ISP Linden
Linden, NJ

BROWN AND CALDWELL

\\bcmah01\projects\^Clients\LCP\21405(Ph_I_RI)\PhaseII_RI_WP\Historic_Drainage\Figures\Fig1-2(Model_Map).ppt



LEGEND

- LOCATION OF MONITORING WELL
- LOCATION OF WELLPOINT OR STANDPIPE
- LOCATION OF WELLS INSTALLED BY OTHERS
- LOCATION OF STAFF GAUGE
- EDGE OF SURFACE WATER BODIES
- 3.5 — WATER TABLE CONTOUR LINE (DASHED WHERE INFERRED)
- (4.05) WATER TABLE ELEVATION (FEET ABOVE/BELOW MEAN SEA LEVEL)

NOTE:

STAFF GAUGE MEASUREMENTS COLLECTED FROM TIDAL SURFACE WATER BODIES DO NOT CORRELATE WITH GROUNDWATER ELEVATIONS WHICH ARE NOT EFFECTED BY THE TIDE.

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY
2	MONITORING WELL AND WELL POINT UPDATE	J.H.S.	11/2/90	S.D.M.
1	MONITORING WELL AND WELLPOINT UPDATE	J.H.S.	6/5/89	S.D.M.

ECKENFELDER INC.
Nashville, Tennessee
Mahwah, New Jersey

GAF CHEMICALS CORPORATION
LINDEN UNION COUNTY, NEW JERSEY

WATER TABLE CONTOUR MAP
UPPER WATER BEARING ZONE
(12-17-90)

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY	
J.H.S.	5/89	S.D.M.	R.D.M.	5/91

FIGURE 1-3

DRAWING NUMBER 6070-021

LEGEND

- GAF-7S — LOCATION OF MONITORING WELL
- WP-8 — LOCATION OF WELLPOINT OR STANDPIPE
- TC-1N — LOCATION OF WELLS INSTALLED BY OTHERS
- LOCATION OF STAFF GAUGE
- EDGE OF SURFACE WATER BODIES
- 5.0 — PIEZOMETRIC SURFACE CONTOUR LINE (DASHED WHERE INFERRED)
- (3.56) — WATER TABLE ELEVATION (FEET ABOVE / BELOW MEAN SEA LEVEL)

NOTE:

PIEZOMETRIC MEASUREMENTS IN BEDROCK WELLS HAVE BEEN CONVERTED TO EQUIVALENT FRESH WATER HEAD THROUGH A CORRECTION FOR WATER DENSITY. REFER TO TEXT SECTION 4.2.4.

200 0 200 400
scale feet

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY
2	MONITORING WELL AND WELL POINT UPDATE	J.H.S.	11/2/90	S.D.M.
1	MONITORING WELL AND WELLPOINT UPDATE	J.H.S.	6/5 /89	S.D.M.

ECKENFELDER INC.
Nashville, Tennessee
Mahwah, New Jersey

GAF CHEMICALS CORPORATION
LINDEN UNION COUNTY, NEW JERSEY

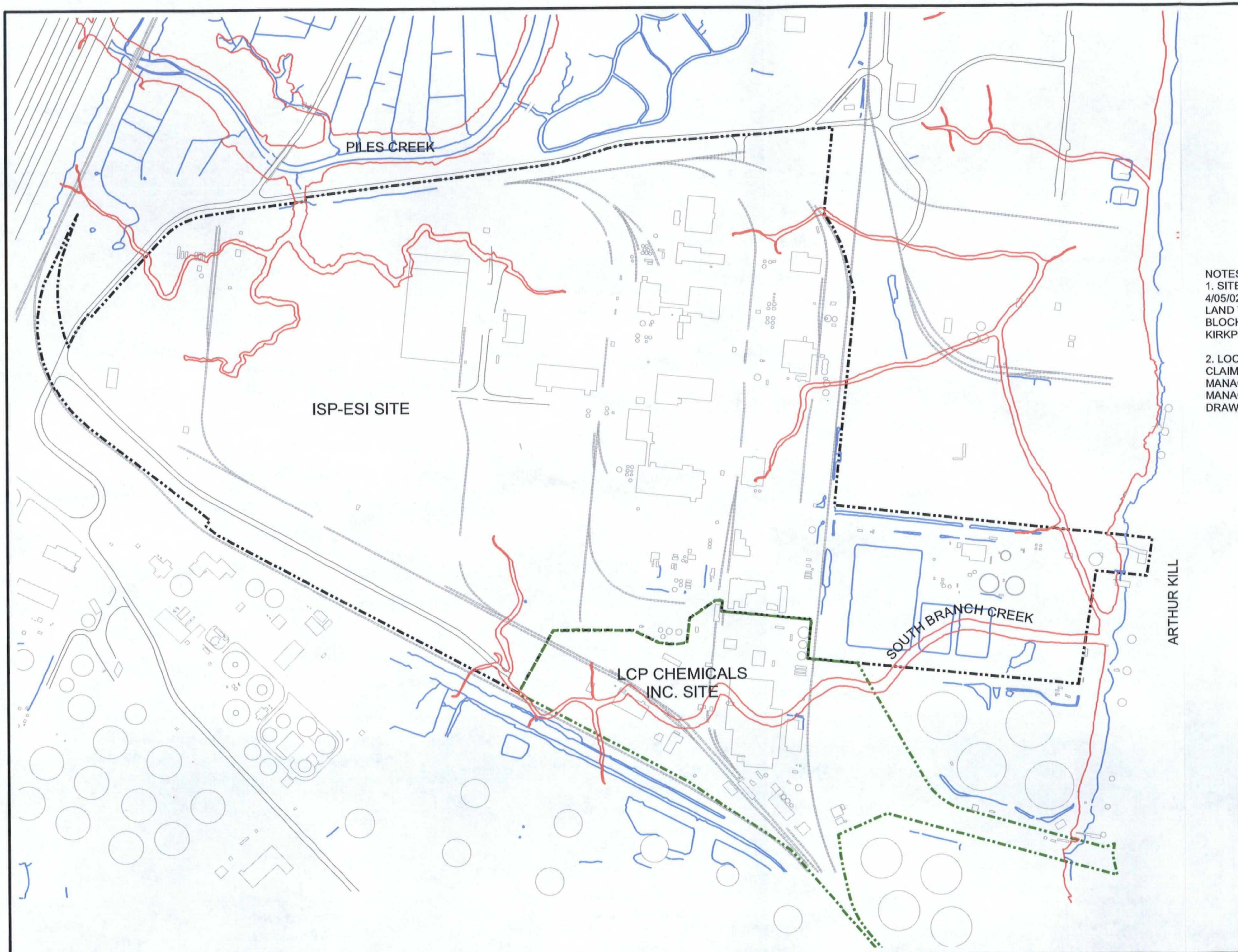
CORRECTED PIEZOMETRIC CONTOUR MAP
BEDROCK AQUIFER
(11-19-90)

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY	
J.H.M.	3/90	S.D.M.	R.D.M.	5/91

FIGURE 1-4

DRAWING NUMBER 6070-023



LEGEND

Current LCP Property Line

Current ISP Property Line

Location of Former Tidal Creeks

NOTES:
1. SITE MAP AND EXISTING SITE FEATURES AS OF 4/05/02 OBTAINED FROM DRAWING TITLED "ALTA/ACSM LAND TITLE SURVEY, ISP ENVIRONMENTAL SERVICES INC., BLOCK 587, LOTS 1 & 2. 10", PREPARED BY KELLER & KIRKPATRICK, (PROJ NO. 2020408. 10, 8/26/03).

2. LOCATIONS OF FORMER TIDAL CREEKS FROM RIPARIAN CLAIMS MAPS OBTAINED FROM NJDEP, LAND USE MANAGEMENT COMPLIANCE, AND BUREAU OF TIDELANDS MANAGEMENT AS SHOWN ON KELLER & KIRKPATRICK DRAWING LISTED IN NO. 1, ABOVE.

FIGURE 1-5
LOCATION OF HISTORIC TIDAL CREEKS

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

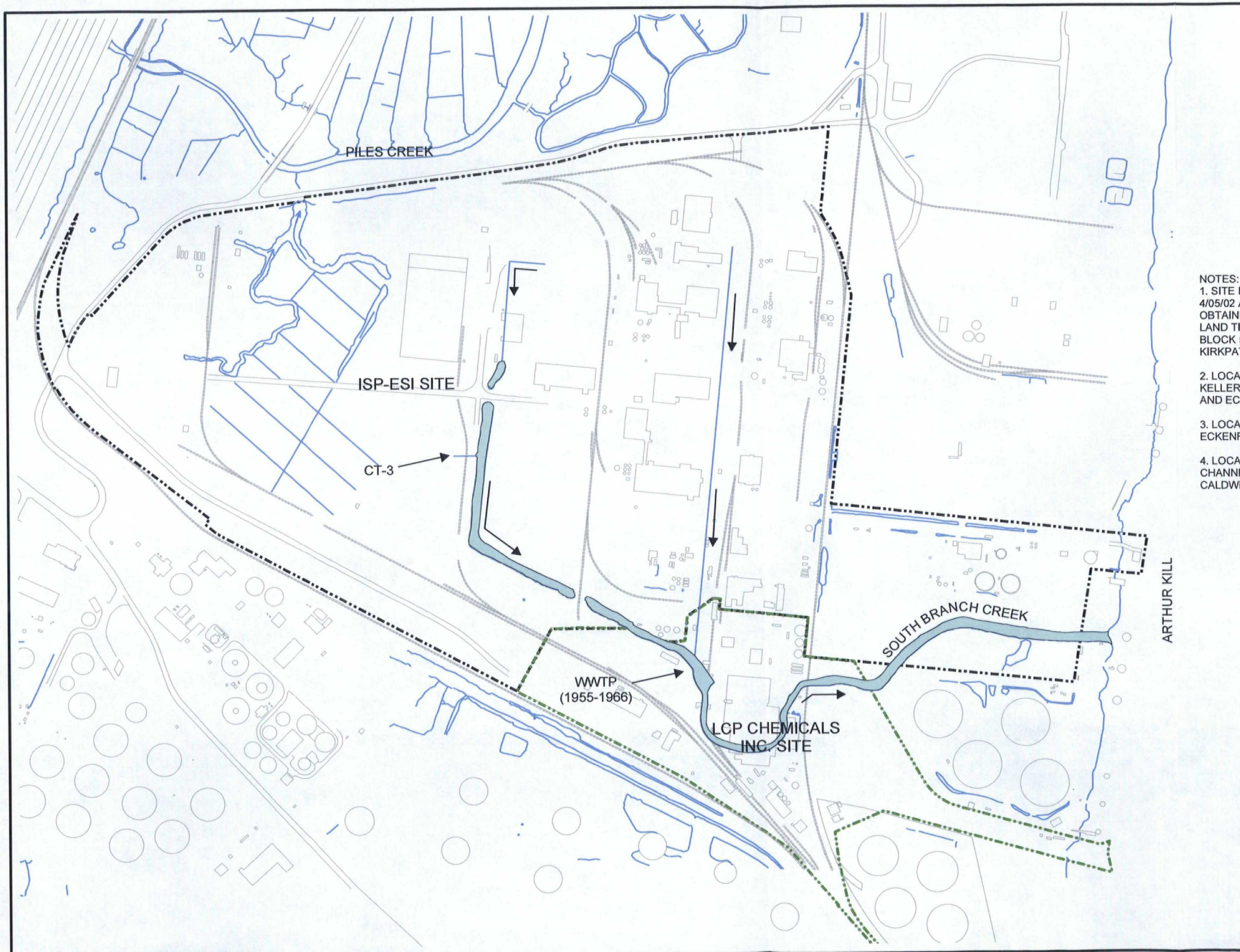


FIGURE 1-6
HISTORIC DRAINAGE
PATTERN MAP
(1951-1966)

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

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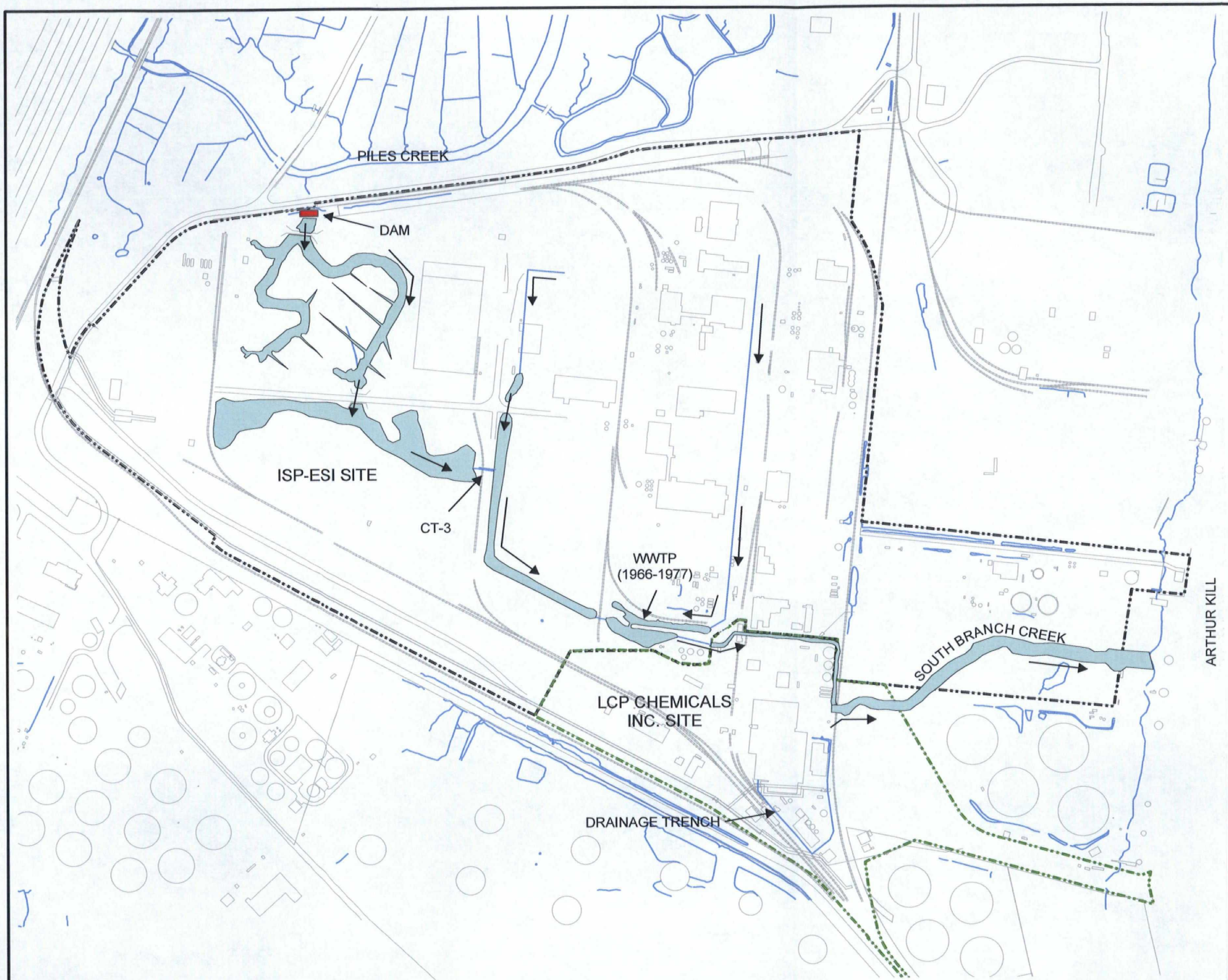

LEGEND

- Current LCP Property Line
- Current ISP Property Line
- Site Drainage Channels
- Surface Water Flow Direction

NOTES:

1. SITE MAP AND EXISTING SITE FEATURES AS OF 4/05/02 ARE SHOWN IN GRAY. INFORMATION OBTAINED FROM DRAWING TITLED "ALTA/ACSM LAND TITLE SURVEY, ISP ENVIRONMENTAL SERVICES INC., BLOCK 587, LOTS 1 & 2. 10", PREPARED BY KELLER & KIRKPATRICK, (PROJ NO. 2020408. 10, 8/26/03).

2. LOCATIONS OF RECENT DRAINAGE CHANNELS FROM KELLER & KIRKPATRICK DRAWING NO.1, ABOVE, AND ECKENFE;DER INC. DRAWING NO. 6070-003 , ABOVE.

3. LOCATIONS OF HISTORIC DRAINAGE CHANNELS FROM ECKENFELDER INC. DRAWING LISTED IN NO. 3 ABOVE.

4. LOCATION OF FORMER SOUTH BRANCH CREEK CHANNEL SOUTH OF THE LCP SITE OBTAINED BY BROWN & CALDWELL FROM AERIAL PHOTOGRAPHY DATED 5/16/54.

N

400 200 0 400 Feet

FIGURE 1-7
HISTORIC DRAINAGE PATTERN MAP
(1966-1971)

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

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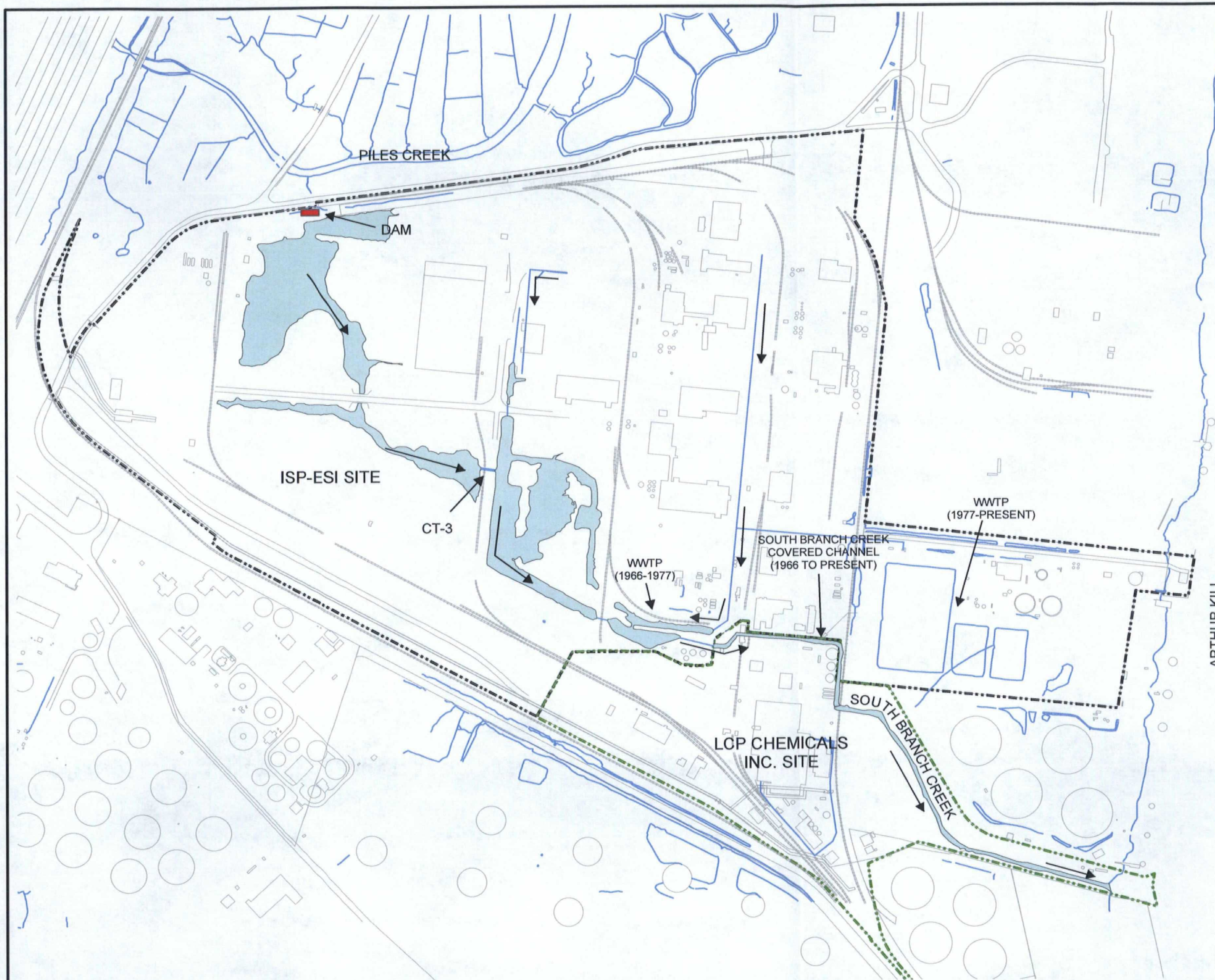

LEGEND

- Current LCP Property Line
- Current ISP Property Line
- Site Drainage Channels
- Surface Water Flow Direction

NOTES:

1. SITE MAP AND EXISTING SITE FEATURES AS OF 4/05/02 ARE SHOWN IN GRAY. INFORMATION OBTAINED FROM DRAWING TITLED "ALTA/ACSM LAND TITLE SURVEY, ISP ENVIRONMENTAL SERVICES INC., BLOCK 587, LOTS 1 & 2. 10", PREPARED BY KELLER & KIRKPATRICK, (PROJ NO. 2020408. 10, 8/26/03).

2. LOCATIONS OF RECENT DRAINAGE CHANNELS FROM KELLER & KIRKPATRICK DRAWING NO.1, ABOVE, AND ECKENFE;DER INC. DRAWING NO. 6070-003 , ABOVE.

3. LOCATIONS OF HISTORIC DRAINAGE CHANNELS FROM ECKENFELDER INC. DRAWING LISTED IN NO. 3 ABOVE.

4. LOCATION OF FORMER SOUTH BRANCH CREEK CHANNEL SOUTH OF THE LCP SITE OBTAINED BY BROWN & CALDWELL FROM AERIAL PHOTOGRAPHY DATED 5/16/54.

FIGURE 1-8
HISTORIC DRAINAGE PATTERN MAP
(1971-1977)

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

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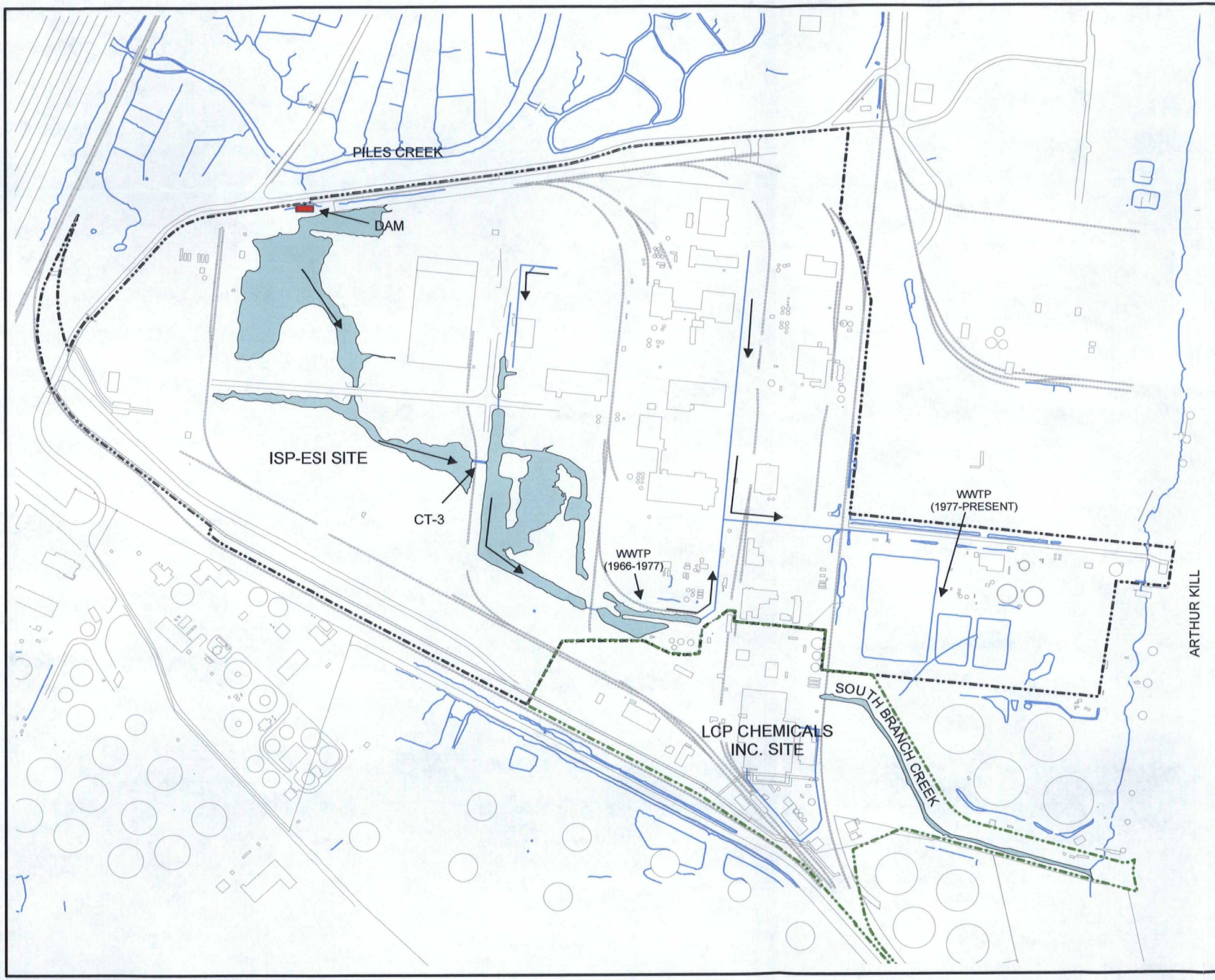


LEGEND

- Current LCP Property Line
- Current ISP Property Line
- Site Drainage Channels
- Surface Water Flow Direction

N

400 200 0 400
Feet

NOTES:
1. SITE MAP AND EXISTING SITE FEATURES AS OF 4/05/02 ARE SHOWN IN GRAY. INFORMATION OBTAINED FROM DRAWING TITLED "ALTA/ACSM LAND TITLE SURVEY, ISP ENVIRONMENTAL SERVICES INC., BLOCK 587, LOTS 1 & 2. 10", PREPARED BY KELLER & KIRKPATRICK, (PROJ NO. 2020408. 10, 8/26/03).

2. LOCATIONS OF RECENT DRAINAGE CHANNELS FROM KELLER & KIRKPATRICK DRAWING NO.1, ABOVE, AND ECKENFE;DER INC. DRAWING NO. 6070-003 , ABOVE.

3. LOCATIONS OF HISTORIC DRAINAGE CHANNELS FROM ECKENFELDER INC. DRAWING LISTED IN NO. 3 ABOVE.

4. LOCATION OF FORMER SOUTH BRANCH CREEK CHANNEL SOUTH OF THE LCP SITE OBTAINED BY BROWN & CALDWELL FROM AERIAL PHOTOGRAPHY DATED 5/16/54.

FIGURE 1-9
HISTORIC DRAINAGE PATTERN MAP (1977-2003)

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

P:/GIS/LCP/Fig_1-9(Hist_Drainage_1977-2003).mxd

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Approximate Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-1
ISP LINDEN SITE
APRIL 20, 1951

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

400 200 0 400 Feet

FIGURE 2-2
ISP LINDEN SITE
AND LCP SITE
APRIL 20, 1951

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Approximate Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-3
ISP LINDEN SITE
APRIL 20, 1954

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

FIGURE 2-4
ISP LINDEN SITE
AND LCP SITE
APRIL 20, 1954

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-5
ISP LINDEN SITE
MAY 16, 1954

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW Standing Water
FL Fill
C Channel
TC Tidal Creek Channel
MD Mosquito Ditch
EOP Ethylene Oxide Plant
B120 Building 120
R Road
CT Culvert
BR Bridge
SBC South Branch Creek
OPL Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

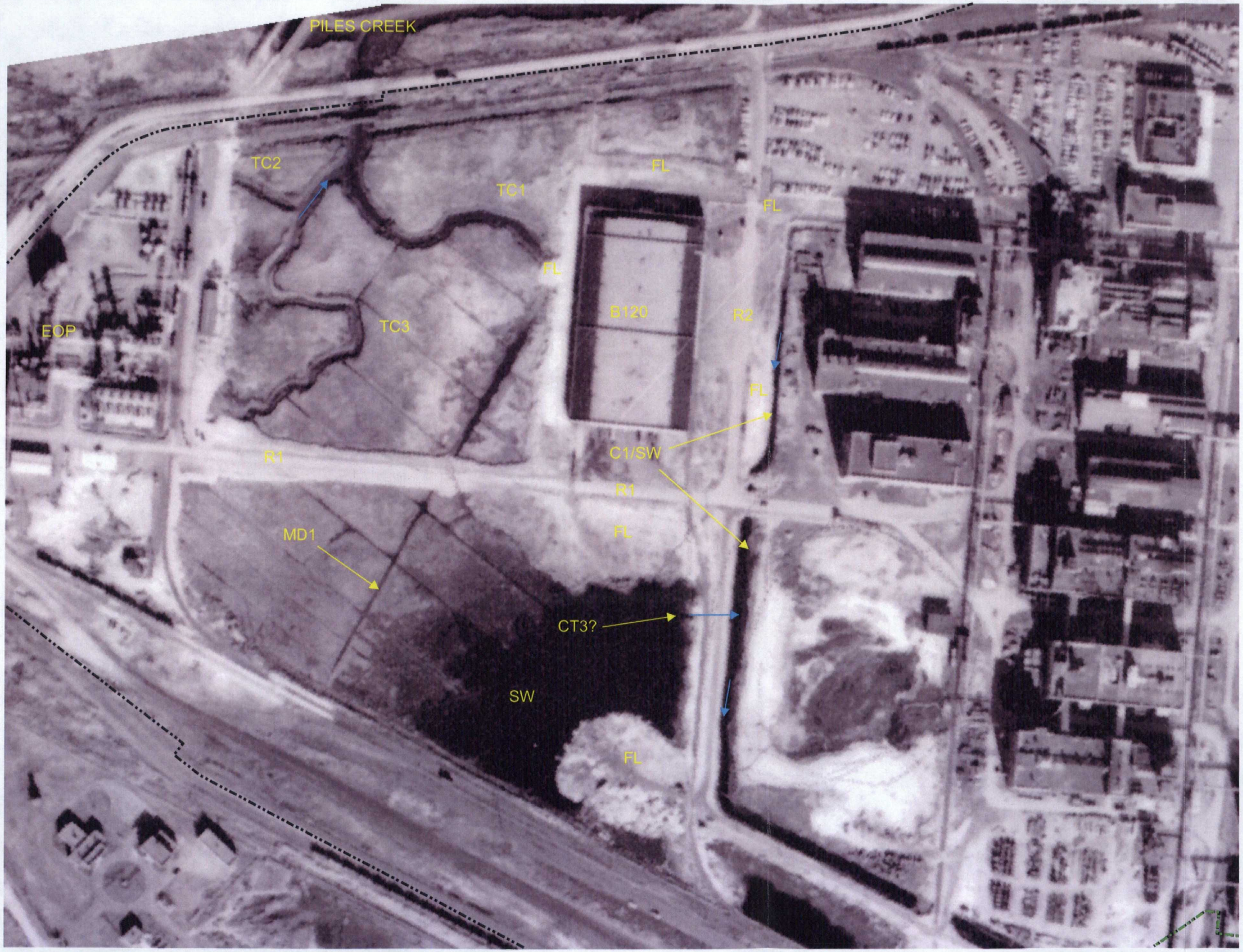
N

400 200 0 400
Feet

FIGURE 2-6
ISP LINDEN SITE
AND LCP SITE
MAY 16, 1954

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL



LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-7
ISP LINDEN SITE
NOVEMBER 20, 1958

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

FIGURE 2-8
ISP LINDEN SITE
AND LCP SITE
NOVEMBER 20, 1958

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-9
ISP LINDEN SITE
APRIL 3, 1959

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

FIGURE 2-10
ISP LINDEN SITE
AND LCP SITE
APRIL 3, 1959

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

FIGURE 2-11
ISP LINDEN SITE
APRIL 23, 1961

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

400 200 0 400 Feet

FIGURE 2-12
ISP LINDEN SITE
AND LCP SITE
APRIL 23, 1961

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-13
ISP LINDEN SITE
DECEMBER 4, 1966

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

400 200 0 400 Feet

FIGURE 2-14
ISP LINDEN SITE
AND LCP SITE
DECEMBER 4, 1966

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-15
ISP LINDEN SITE
APRIL 11, 1967

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW Standing Water
FL Fill
C Channel
TC Tidal Creek Channel
MD Mosquito Ditch
EOP Ethylene Oxide Plant
B120 Building 120
R Road
CT Culvert
BR Bridge
SBC South Branch Creek
OPL Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

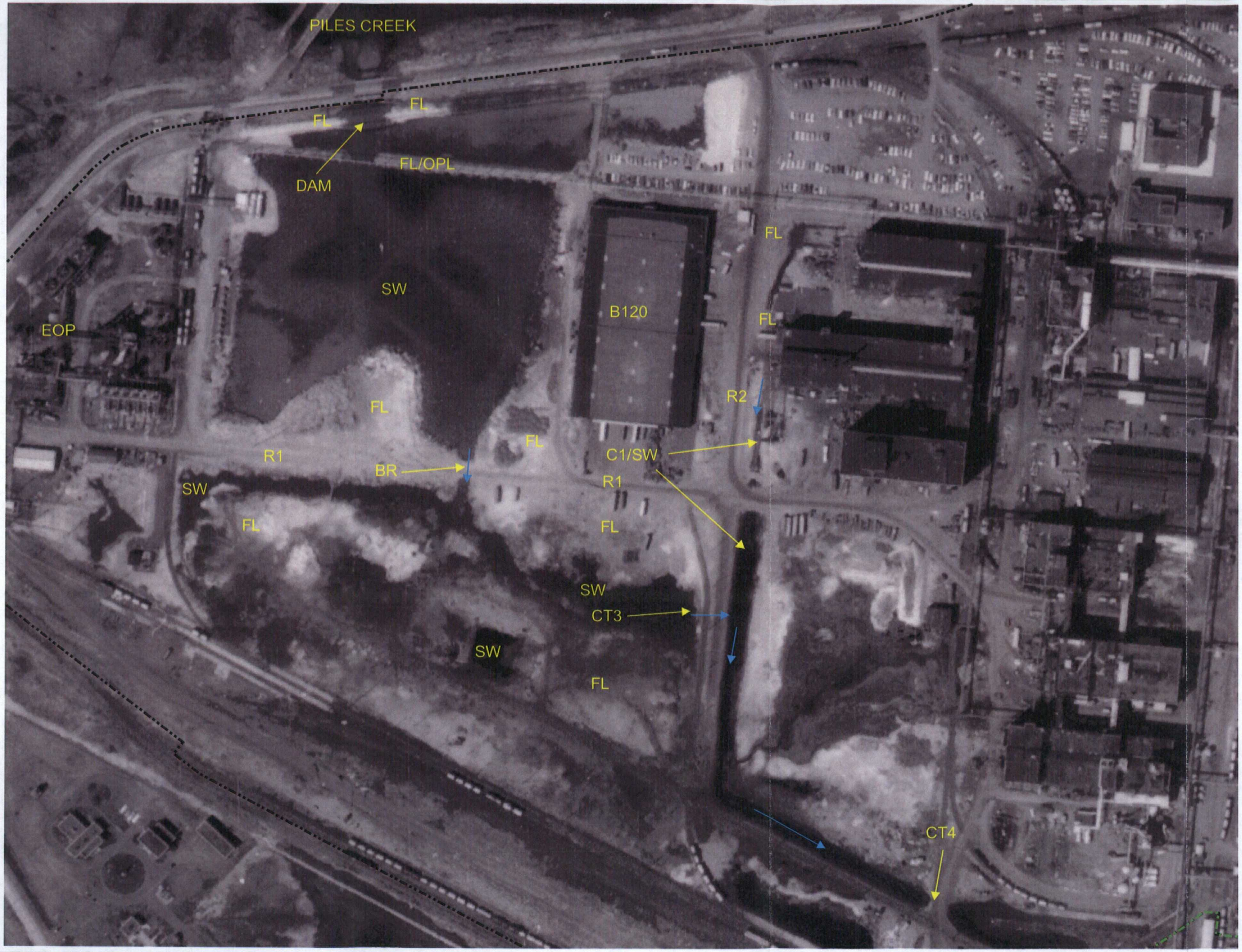
N

400 200 0 400 Feet

FIGURE 2-16
ISP LINDEN SITE
AND LCP SITE
APRIL 11, 1967

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL



LEGEND

SW Standing Water
FL Fill
C Channel
TC Tidal Creek Channel
MD Mosquito Ditch
EOP Ethylene Oxide Plant
B120 Building 120
R Road
CT Culvert
BR Bridge
SBC South Branch Creek
OPL Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-17
ISP LINDEN SITE
APRIL 16, 1968

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

400 200 0 400 Feet

FIGURE 2-18
ISP LINDEN SITE
AND LCP SITE
APRIL 16, 1968

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-19
ISP LINDEN SITE
APRIL 9, 1977

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

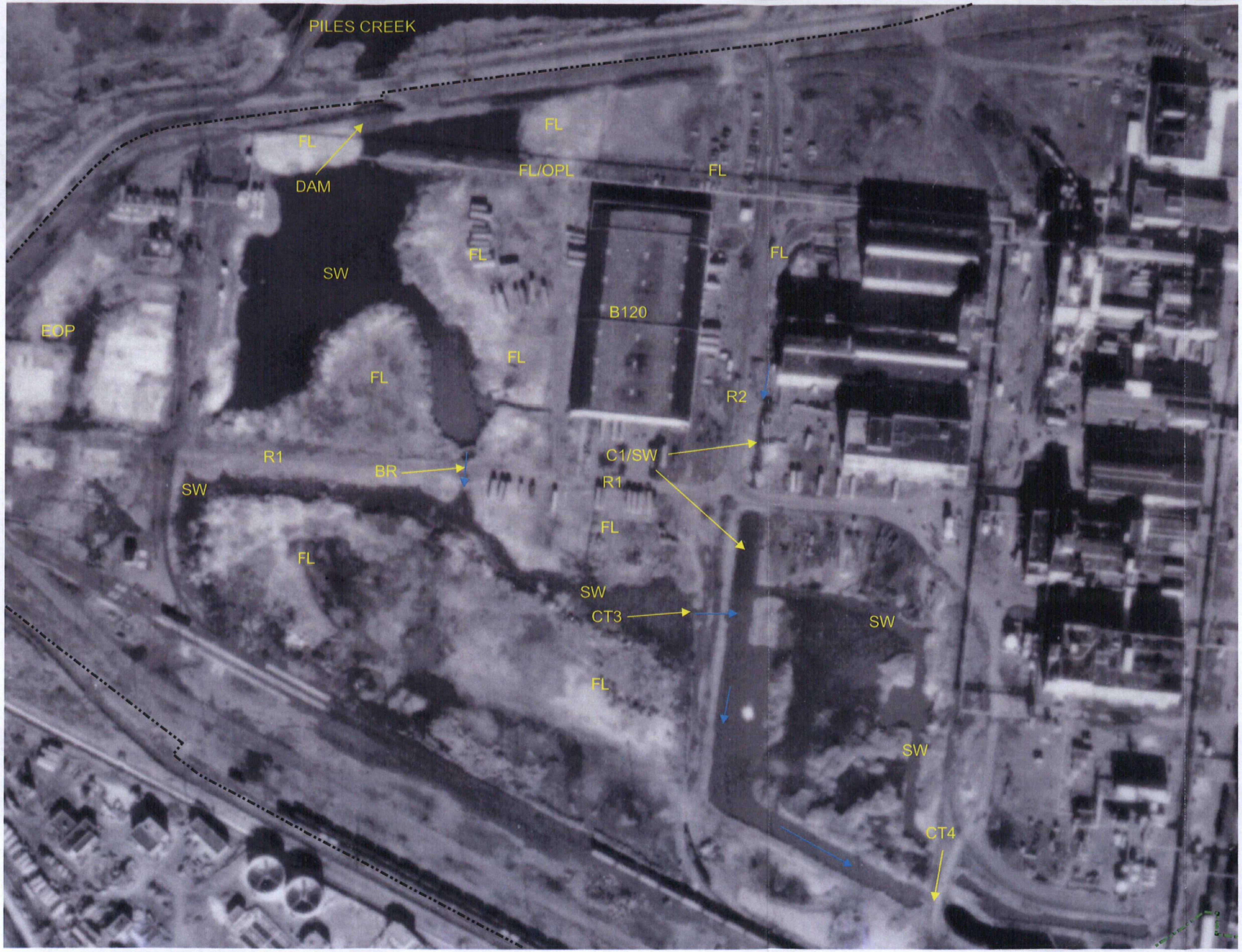
Current LCP Property Line

Current ISP Property Line

FIGURE 2-20
ISP LINDEN SITE
AND LCP SITE
APRIL 9, 1977

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL



LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

FIGURE 2-21
ISP LINDEN SITE
DECEMBER 22, 1978

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

FIGURE 2-22
ISP LINDEN SITE
AND LCP SITE
DECEMBER 22, 1978

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-23
ISP LINDEN SITE
NOVEMBER 15, 1988

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

400 200 0 400 Feet

FIGURE 2-24
ISP LINDEN SITE
AND LCP SITE
NOVEMBER 11, 1988

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

200 100 0 200 Feet

FIGURE 2-25
ISP LINDEN SITE
1995

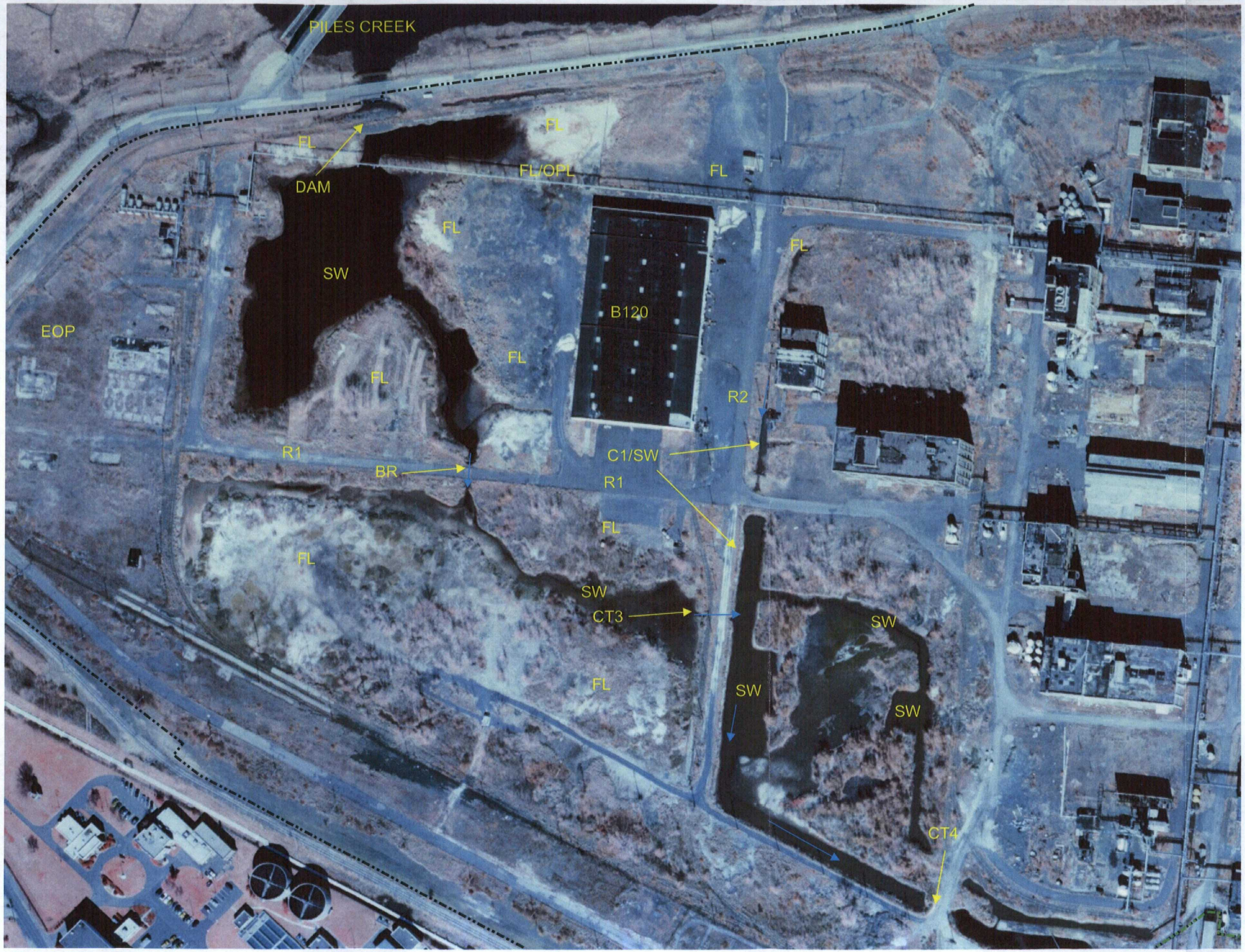
LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

FIGURE 2-26
ISP LINDEN SITE
AND LCP SITE
1995

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL



LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

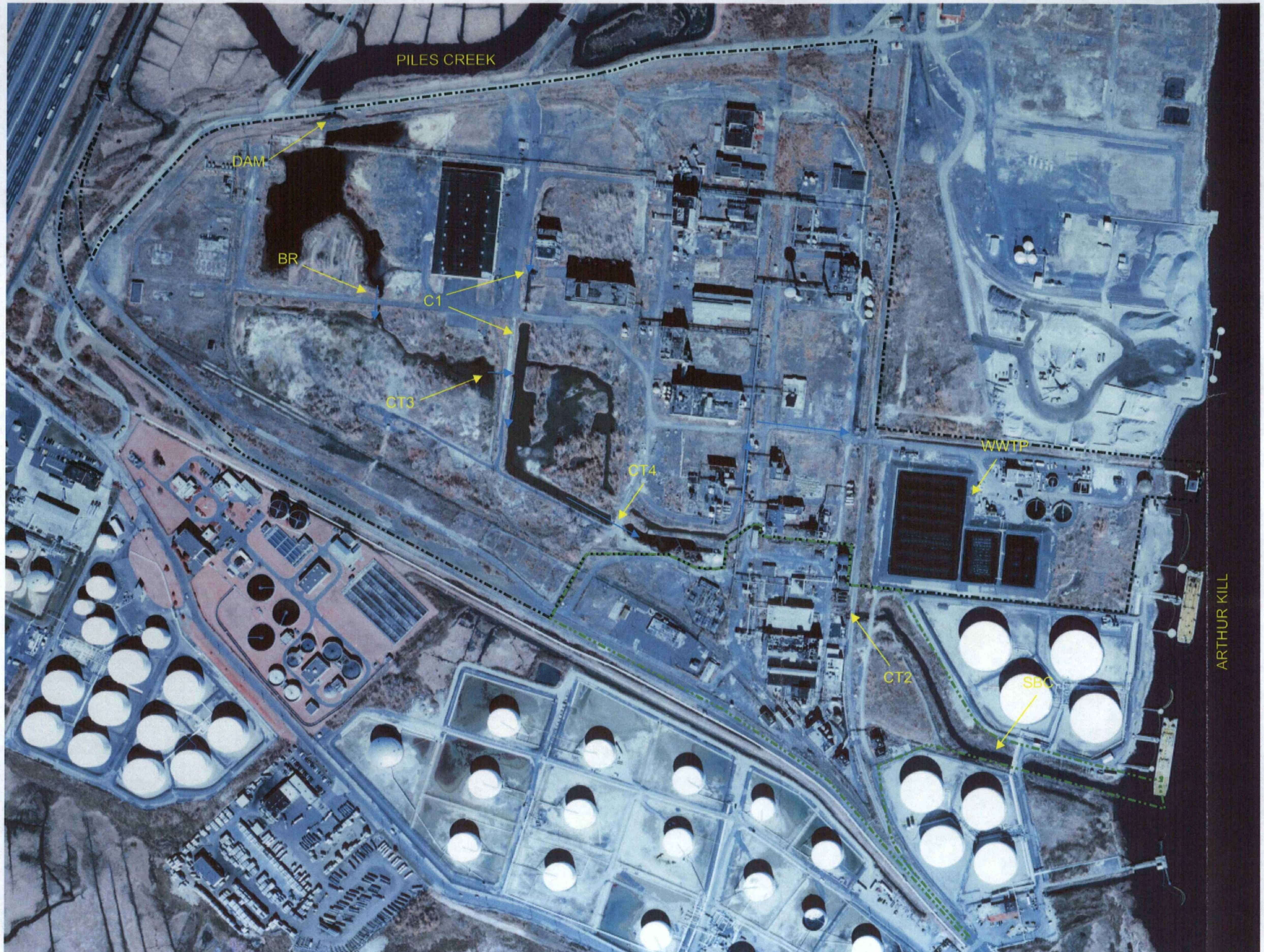
Current LCP Property Line

Current ISP Property Line

FIGURE 2-27
ISP LINDEN SITE
SPRING 2002

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL



LEGEND

SW	Standing Water
FL	Fill
C	Channel
TC	Tidal Creek Channel
MD	Mosquito Ditch
EOP	Ethylene Oxide Plant
B120	Building 120
R	Road
CT	Culvert
BR	Bridge
SBC	South Branch Creek
OPL	Overhead Power Lines

Apparent Surface Flow Direction

Current LCP Property Line

Current ISP Property Line

N

400 200 0 400 Feet

FIGURE 2-28
ISP LINDEN SITE
AND LCP SITE
SPRING 2002

LCP Chemicals, Inc. Superfund Site
Linden, New Jersey

BROWN AND CALDWELL

Exhibit N

LCP CHEMICALS - NEW JERSEY
FOOT OF SOUTH WOOD AVENUE
LINDEN CITY, UNION COUNTY, NEW JERSEY
EPA ID# NJD079303020

LCP owns a twenty-six (26) acre chemical manufacturing facility in Linden which is currently used exclusively for the storage and transfer of methylene chloride and caustic soda. GAF Corporation aquired the property in 1950 from the U.S. Government, filled an area of coastal wetlands on site, and developed it for production of liquid chlorine by the mercury cell process. LCP purchased the facility in 1972 from GAF and with a few minor modifications of the process continued chlorine manufacturing until September 1985. Other property within 1.5 miles is zoned for heavy industry (B.P. Oil, E.I. DuPont, GAF, Northville Industries) and transportation (New Jersey Turnpike). Also, Union Carbide operates the Linde Hydrogen Plant (LHP) as a tenant organization at the LCP Linden facility. Site security is adequately maintained by a perimeter chain link fence, a twenty-four (24) hour/day guard staff, and closed circuit TV cameras. Finished products are transported in bulk quantities via tank truck or rail car, and stored on site in three (3) aboveground tanks with a total combined volume of 1.02 million gallons.

The City of Linden is a densely populated urban area, such that, within three miles of the LCP facility an estimated 62,500 people were in residence as of December 1984. Linden is supplied with potable water by surface resevoirs located in Clinton, NJ approximately thirty miles to the west. The Arthur Kill, located almost 1100' off-site to the east is used for recreational boating and an endangered species, the Peregrine Falcon, is known to hunt in the salt marshes nearby.

LCP's Tremley Point Plant is situated directly upon a hetrogeneous fill material composed of sand, gravel, brick, and slag up to 10 or 15 feet thick. Bedrock occurs at 30 to 40 feet below grade and consists of a red sandy shale overlain by 10 to 15 feet of glacial deposits and 20 feet of organic silt, clay and peat. This portion of the New Brunswick Formation is not used as a potable aquifer within several miles of the facility due to the salt intrusion from the nearby coastal waters. LCP was provided all of its' potable and industrial water requirements (430,000 gallons/day when at full production in 1979) from the Elizabethtown Water Company. LCP does maintain five (5), NJPDES Discharge to Ground Water (DGW) permitted, monitoring wells which are screened in sand lenses of the glacial till and organic sediments. Within these wells the depth to water and salt concentrations vary according to the ebb and flow of the tides.

The "mercury cell process" yields chlorine gas through the electrolysis of a sodium chloride (brine) solution in the presence of metalic mercury. An amalgum of mercury and sodium is removed from the cell and used to hydrolize water forming sodium hydroxide and hygrogen gas (which are also comerically valuable). Metalic mercury was recovered and recycled in a brine purification process, but incompletely yielding a sludge residue.

LCP wastes included: mercury contaminated sludges, mercury vapors, spent lubricating oils, transformer oils, degreasing solvents, process wastewater, spill wash down, and stormwater runoff. LCP's tenant LHP purportedly does not generate any hazardous wastes. Mercury sludges were landfilled on-site in the Brine Sludge Lagoon for at least twenty (20) years, until 1982 when LCP began storing this waste in 55 gallon drums prior to shippment off-site. Mercury vapor emissions were discharged to the atmosphere from process equipment and an on-site sludge roaster under permits from the NJDEP DEQ Air Pollution Control Program. Spent lubracating oils, transformer oils, and degreasing solvents were stored in 55 gallon drums before shippment off-site for recovery. Process wastewater, stormwater runoff and spill wash-down from process equipment, the parking lot, and transfer areas was treated then discharged to the South Branch Creek, a tributary of the Arthur Kill (classified "Saline Estuarine waters, SE-2" by the Division of Water Resources).

Plant wastewater and sludges were collected in a 500,000 gallon agitated tank. The dilute slurry was pumped to a 140,000 gallon settling silo No. 4. The supernatant was directed to the effluent treatment system and the settled solids to the 4,500 gallon surge tank at the sludge roaster site. The brine sludge composition was reported by LCP on June 9, 1975 to be: 15 to 20 percent sodium chloride, 40 to 50 percent barium sulfate, 20 to 30 percent calcium carbonate and/or sulfate, 2 percent metal hydroxides, 2 percent dirt, and 100 to 500 ppm mercury. Settling silo No. 4, and the surge tank are no longer maintained at the Linden facility. The collection tank is in service only for emergency purposes as a holding tank for excessive volumes of stormwater.

Effluent treatment consists of pH neutralization, contact with activated carbon, and filtration. Prior to construction of the cooling towers (in 1980) NJPDES Discharge to Surface Water (DSW) permits limitations for temperature were exceeded regularly. Other infractions included occasionally alkaline pH and one major incident on August 20, 1979 when ten to twenty thousand gallons of mercury tainted brine was discharged to the South Branch Creek. An analysis of sediment samples from the creek (below LCP's discharge outfall), as reported by Geragthy and Miller Inc. February 1982, indicates that mercury is present at 46 ppm. LCP began recycling its process wastewater in 1982 and amended the DSW permit to reflect this change. Currently only stormwater runoff and spill wash down after treatment, are discharged.

AREAS OF CONCERN:

Enforcement personnel with the Division of Hazardous Waste Management reported evidence of numerous small releases observed during inspections in 1980, 81, 82, and 83.

9/17/80 Brine sludge was observed on the gravel near the 500,000 gallon "collection tank."

10/9/80 Brine sludge was observed on the gravel in the vicinity of "Settling Silo #4."

1/21/81 During the inspection a liquid was observed spewing from a cracked PVC pipe near the 500,000 gallon collection tank and the pump pit.

3/19/81 An acid spill (9' x 4') was noted on the soil near Building #220 and Avenue C.

10/22/81 A brine sludge slurry release from a transfer line was evidenced by a 1' x 15' spill area located on Avenue B between the pump pit and the Brine sludge Lagoon. Also, a 10' x 4' hydrochloric acid spill area was noted approximately 15' northwest of the 500,000 gallon collection tank.

11/19/81 The brine sludge slurry spill area noted on the previous inspection has expanded to cover a 125' x 30' area along the railraod tracks.

4/13/82 Sodium sulfide crystals were evident on the gravel surface in the pump pit area. Also noted was a salt spill at the railroad siding area.

8/5/82 Yellow crystals (probably sodium sulfide) was observed to cover a 10' x 15' area of broken asphalt near building #240.

2/28/83 Approximately two cubic yards of rubber liner from the caustic tank were deposited within the brine sludge lagoon in violation of the DEQ ACO.

Late in 1982, LCP paved the railroad siding and adjacent areas, the area under the salt silos, and sections of Avenue C.

In addition to the areas noted by DEP personnel a former employee of LCP has alleged several other sites of possible contamination.

1. The soil surface between the compressor building #231 and the railroad tracks received mercury contaminated sludge which was excavated from the Brine Sludge Lagoon.

2. Prior to OSHA requiring the repair of the cracked and broken concrete floor within the mercury cell Buildings #230 and #240, numerous spills were transmitted to the underlying soils.

3. The willful destruction of unfavorable laboratory analytical results from effluent sampling of the outfall to South Branch Creek may have obscured LCP's impact to the sediments and surface waters downstream of the facility.

The former owner (GAF Corporation) operated a Waste Water Treatment Plant (WWTP) at this facility, principally for pH neutralization, through the 1950's, 60's, and early 70's. Purportedly the site of this treatment system was paved over and is currently used to maintain an extensive electrical power transformer substation.

UNIT ANALYSIS:
There are four (4) Solid Waste Management Units (SWMU's) at the LCP facility in Linden. The "Brine" Sludge Lagoon" is the only RCRA regulated unit. The "Chem-Fix" Lagoon, the "Sludge Roaster", and the "Container Storage Area" (CSA) comprize the remaining three units. A RCRA part A permit application was submitted by LCP on August 13, 1980. Since the only TSD activity on-site (the Brine Sludge Lagoon) was certified closed in September 1985 the part B application was considered unnecessary in lieu of a post closure permit.

1. The Brine Sludge Lagoon was an unlined surface impoundment in which mercury contaminated sludges were disposed of for twenty (20) years or more. The lagoon was roughly a trapezium, approximately 275' x 200' x 220' x 80', and the accumulated waste volume estimated at 30,000 cubic yards. Analysis of the sludge in the lagoon was performed by the Princeton Testing Laboratories June 15, 1981 which indicated that mercury was present at 340 ppm.

   In order to preclude worker exposure to mercury vapors eminating from the disturbed surface of the Brine sludge and Chem-Fix lagoons during closure operations, the USEPA and NJDEP required LCP to suspend manufacturing and restrict access to the site from 1982 until 1984. Closure operations (concluded September 1985) included a clay cap, soil cover, grading, and seeding.

   Five (5) shallow NJPDES permitted wells monitor leachate releases to the phreatic surface. Quaterly reports of analysis from these wells indicate that concentrations of the metals: lead, chromium, cadmium, mercury, selenium, silver, and radium have exceeded permitted parameters on several occasions between 1982 and 1987. Elevated mercury levels detected in the soils from the monitor well borings (up to 500 ppm) and from the land surface (up to 1,500 ppm) are, according to a Geraghty and Miller Inc. report dated February 1982, "the result of present or prior land use" and "represent low solubility compounds of sulfides, phosphates, or carbonates."

   In a recently issued NJPDES DGW permit, four (4) additional wells are mandated in order to fully characterize the local water table and adequately monitor leachate from this unit. During the December 22, 1987 RCRA walk through site inspection conducted by personnel of the Bureau of Planning and Assessment, the HNu meter detected organic vapors eminating from the headspace of existing monitor wells P-1 and P-2. The NJPDES 30 year post closure monitoring program should be expanded to include an initial scan for priority pollutants and volatile organic compounds. Further investigation of this unit is unwarranted at this time.

2. The Chem-Fix Lagoon was a surface impoundment, used briefly in 1976 for experiments in stabilizing the mercury constituents of the brine sludge. This lagoon was roughly triangular, 60 to 80 feet on each side, with a total surface area of approximately 3,000 square feet. The lagoon dikes were constructed to a height of 8 feet with an earthern core and crushed stone cover. Two (2) 0.20 mil thick visquene plastic liners were installed in the lagoon which was also

equipped with perforated under drain system for leachate collection. The lagoon contents, 460 cubic yards of treated brine sludge, was transfered to the Brine Sludge Lagoon in 1983. The Chem-Fix lagoon was subsequently excavated, filled, graded, and seeded. The proximity of the Chem-Fix Lagoon site to the Brine Sludge Lagoon site enables the NJPDES DGW permitted wells to monitor any leachate releases to the ground water from either unit. A further investigation of the Chem-Fix Lagoon is not warranted at this time.

3. The Sludge Roaster was designed and built in 1978 to vaporize mercury from steam dryed brine sludge, and thereby decontaminate the waste sufficiently to allow for final disposal at an off-site sanitary landfill. The roaster system was situated on a 16' x 40' concrete pad, one (1) foot thick, equipped with surface drainage channels (connected to the Waste Water Treatment Plant) and a cinder block curb. An Administrative Consent Order (ACO) issued September 1, 1981 required LCP to submit an application for a Hazardous Waste Facility (HWF) permit to operate the roaster unit. On June 30, 1982 the Bureau of Hazardous Waste Engineering (BHWE) denied the permit and LCP subsequently abandoned the process.

   A November 5, 1981 inspection by enforcement personnel of the Division of Environmental Quality, Air Pollution Control Program discovered a ruptured muffler plate on the sludge roaster that allowed excessive quantities of mercury vapors to be released to the atmosphere. Starting in 1985, this unit was dismantled and most of the components shipped to other LCP facilities around the country. No further investigation of the sludge roaster is warranted at this time.

4. The Container Storage Area (CSA) is a 300 square foot concrete pad, 1 foot thick with a 4 to 8 inch curb. Approximately 40 (55 gallon) drums or 2,000 gallons of waste: lubracating oils, transformer oils, disgreasing solvents, and dewatered brine sludges could have been stored on this unit at any one time. These wastes were shipped off-site for proper disposal within 90 days. During the recent RCRA walk through inspection (December 22, 1987) no containerized wastes were present at this unit, however the surface of the pad was covered with an absorbant material (speedy-dry) and some oily residues were noted on the gravel in the surrounding area. A limited investigation in the vicinity of the container storage area should be performed to determine the extent of contamination which may have occurred.

PERMITS:

NJPDES Discharge to Surface Water (DSW) permit #NJ0003778 grants LCP permission to discharge stormwater runoff and spill wash-down, after treatment, through one outfall to South Branch Creek (classified SE-3). This DSW permit was issued August 10, 1987 and is effective until April 30, 1991.

NJPDES Discharge to Ground Water (DGW) permit #NJ0003778 grants LCP permission to continue post-closure ground water monitoring of the wells surrounding the closed lagoons and to implement the modified Post-Closure Plan. "The potential discharge is leachate from the lagoon to the ground waters of the State, to the organic (marsh) deposits of recent geologic age, the Raritan-Magothy formation of the Cretaceous age, and the New Brunswick formation of the Jurassic age." The DGW permit was issued October 30, 1987 and is effective until November 29, 1992.

Air Pollution Control permit #044133 was issued on March 3, 1980 granting LCP permission to operate the Sludge Roaster System. This permit expired on October 5, 1982 well after LCP suspended operation of the roaster November 7, 1981.

Other Air Permits included:

PERMIT #	UNIT	EXPIRATION DATE
067418	Boiler Stack	2/17/89
020928	Pura-SIV stack	11/9/85
037033	Mercury Cell Destruct Tower	3/26/89
040435	Mercury Cell Destruct Tower	3/26/88
076056	Mercury Cell Destruct Tower	5/15/87
036994	HCL Scrubber	6/11/88
036993	HCL Scrubber	11/20/88
035067	HCL Scrubber	3/28/88

REGULATORY ACTIONS:
An Administrative Consent Order (ACO), was issued September 1, 1981 by the NJDEP Division of Environment Quality. The ACO required LCP to apply for a permit to operate the Sludge Roaster as a hazardous waste treatment facility, to submit bi-weekly progress reports of activities at the brine sludge lagoon, to submit applications for closure of the Chem-Fix Lagoon and the Brine Sludge Lagoon, and to fully evaluate all potential avenues of release to the ambient environment (ie. air monitoring, groundwater monitoring, soil boring, and surface water monitoring).

A Civil Administrative Penality of $17,500.00 was assessed against a former tenant at LCP, the Kuhne Chemical Company (KCC) in November 1981. KCC was issued a NJPDES permit #0027707 on September 9, 1974 to discharge uncontaminated, non-contact cooling water to the South Branch Creek. Analysis of effluent sampling from KCC's outfall, conducted January 1981, revealed extremely elevated concentrations of caustics and free chlorine (up to 124,430 ppm) and a correspondingly excessive alkaline pH. Aside from the obvious violation of permit parameters the DWR alleged KCC's discharge of waste materials was deliberate.

RECOMMENDATIONS:
Of the four SWMU's at LCP Chemicals in Linden only one unit, the CSA requires corrective action under the RCRA post closure permit program. A limited investigation to include soil sampling in the vicinity of the CSA is necessary to determine the nature and extent of contamination which may have resulted from past spill events.

The previously cited "Areas of Concern" which remain accessible, also require soil sampling to verify that adequate remediation was accomplished at the numerous, documented sites of small spills and past releases.

Currently an investigation of the Brine Sludge Lagoon and the Chem-Fix Lagoon is under the auspices of a NJDEP DWR thirty year, post closure ground water monitoring program. Considering of the longevity of the Brine Sludge Lagoon and the detected presence of VOC's in the well heads during the RFA-VSI, the NJPDES DGW permit should be modified to require an initial scan for priority pollutants and volatile organic compounds. Further investigation and/or corrective action under RCRA may be necessary at some future date pending results of the present survey.

The Sludge Roaster System concrete pad was intact and the nearby soils appeared unstained on December 22, 1987 during the RFA-VSI. A further investigation of this unit is unwarranted at this time.

All actions taken at this facility by the USEPA should be integrated with previous activities and closely coordinated with the NJDEP.

Submitted by:

Kenneth Conrow

Kenneth Conrow, HSMS IV
NJDEP, DHWM - BPA

I. DOCUMENTS REVIEWED

	DOCUMENT NAME	DATE	AUTHOR	LOCATION	NO. PAGES
1.	Waste Lagoon GW Monitoring	2/82	G&M Inc.	BGWQ	50
2.	Closure & Post Closure Plans	10/21/86	BHWE	BHWE	30
3.	GW, SW, & Sediment Sampling	1980-87	LCP INc.	BGWQ	200
4.	Review & Evaluation GW Monitoring	6/84	G&M Inc.	BGWQ	[illegible]
5.	Evaluation and Site Inspection	5/82	EPA Edison, NJ	EPA Edison, NJ	20
6.	Closure & Post Closure Plans	10/16/86	LCP	BHWE	50
7.	Closure & Post Closure Plans	8/84	BGWQ	BGWQ	80
8.	Closure Plan Chem-Fix Lagoon	10/81	LCP	BHWE	30
9.	Closure Approval	11/7/83	BHWE	BHWE	20
10.	Preliminary Report on Brine Sludge	6/9/75	Chem Fix Inc.	BHWE	20
11.	Sludge Roaster Plans & Sludge Analysis	1981/1982	LCP Inc.	BHWE	50
12.	Health & Inspect Statement	1981	LCP Inc.	BHWE	[illegible]
13.	Site Inspections	1980-83	DHWM Enforcement	Metro	200
14.	NJPDES Permits	10/87	BGWQ	BGWQ	100
15.	Report of telephone call	6/25/80	DHWM Enforcement	Metro	1
16.	Report of telephone call	1/25/81	DHWM Enforcement	Metro	1
17.	Report of telephone call	12/2/80	DHWM Enforcement	Metro	1
18.	Compliance Monitoring Report	5/78	DWR Enforcement	Metro	20

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I. DOCUMENTS REVIEWED

	DOCUMENT NAME	DATE	AUTHOR	LOCATION	NO. PAGES
19.	Compliance Monitoring Report	2/79	DWR Enforcement	Metro	25
20.	ACO	9/1/81	DEQ Enforcement	Metro	20
21.	Record of Violation	7/19/85	DEQ Enforcement	Metro	2
22.	Discharge Report	2/7/79	DEQ Enforcement	Metro	1
23.	Order	11/4/81	DEQ Enforcement	Metro	1
24.	Investigation Summary	1/24/74	DEQ Enforcement	Metro	1
25.	Complaint Form	1/27/81	DEQ Enforcement	Metro	1
26.	Letter from LCP to EPA	3/20/87	LCP	Metro	1
27.	Letter from LCP to DWR	4/24/87	LCP	Metro	1
28.	Inspection Report, HRS	12/31/84	NUS Corp.	BPA	150
29.	Georlogy and GW Resources, Union County	4/19/82	USGS	BPA	10
30.	Letter from DFGW to NUS Corp.	11/15/84	DFGW	BPA	1
31.	Air Permits	3/3/80	DEQ-BAPC	Metro	20
32.	EPA Internal Memo	2/24/81	EPA-Region II	DWR, Metro	1
33.	Administrative Penalty	10/7/81	DWR	DWR, Metro	30
34.	NJPDES Permit	8/30/80	DWR	DWR, Metro	15

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II. OFFICES CONTACTED

	OFFICE	CONTACT	TELEPHONE #	CONTACT DATE
1.	BHWE	S. Wilson	(609) 292-9880	12/1/87
2.	BGWQM	J. Monroe	(609) 292-0424	12/3/87
3.	DHWM Metro Enforcement		(201) 669-3960	12/7/87
4.	DWR Metro Enforcement	T. Harrington	(201) 669-3900	12/8/87
5.	DEQ Air Program Enforcement		(201) 669-3935	12/8/87
6.	Linden Board of Health	H. Gaven	(201) 474-8409	12/11/87
7.	DCJ	P. Hayes	(609) 984-3900	12/11/87
8.	Flood Plain Management	P. Inverso	(609) 296-2373	12/14/87
9.	ORS		(609) 292-5697	12/14/87
10.	OEA	M. Ryon	(609) 292-8206	12/22/87
11.	USEPA		(201-321-6658	12/22/87
12.	DWR, Industrial Permits		(609) 292-0407	12/28/87

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Exhibit O

LCP CHEMICALS
FOOT OF SOUTH WOOD AVENUE
LINDEN, UNION COUNTY, NJ
EPA ID# NJD079303020

I. FACILITY OWNERSHIP/BACKGROUND INFORMATION

OWNERSHIP:
LCP Chemicals purchased the 26 acre chlorine production facility in 1972 from General Aniline and Film Corp. (GAF) who owned the facility since 1942. E.I. Dupont owned the land, which according to aerial photographs was coastal marshland, prior to GAF.

LCP leases two sections of their property. The Western section near the guard house, is leased by Union Carbide. They have been leasing the building and property since 1959 when the property was owned by GAF. The other leased section is Building 231. This building is leased by Microcell Technologies, Inc. They have leased the building since 1987. LCP also leased to Kuehne Chemical from 1974 to 1981, who operated in the area that is adjacent to Building 220 (presently a parking lot).

FACILITY OPERATIONS:
GAF began producing chlorine in 1961 by utilizing a "mercury cell electrolysis process". The process involved the electrolysis of a sodium chloride (brine) solution in the presence of metalic mercury. The residual mercury-sodium solution is then used to hydrolize water, forming sodium hydroxide and hydrogen gas. The metalic mercury was partially recovered and recycled in a brine purification process. The remaining mercury tainted sludge was placed into the Brine Sludge Lagoon. When LCP purchased the property they continued to process chlorine using the same process method with a few minor modifications. In 1975, LCP modified the electrolysis process by switching from a graphite anode to a dimensionally stable anode. The components of this anode would allow the leaching of the mercury so that the brine sludge could be recycled. Other products produced at LCP are caustic soda, hydrogen chloride and bleach. (Preliminary Report on Brine Sludge Lagoon).

In 1976, LCP investigated ways to clean the Brine Sludge Lagoon and remove mercury from the wastes that were being produced. They contracted Chem-fix of Pittsburgh to set up a temporary lab and to construct the Chem-fix Lagoon to receive non-contaminated wastes. They operated the lagoon for six days and determined that this was not a practicle means of clean-up and the lagoon was abandoned. LCP investigated the possibility of mercury recovery from the brine sludge via a roasting system in 1978. The roaster was designed and built to vaporize mercury from steam dried sludge. This would allow the solid waste to be shipped off site to a sanitary landfill. An Administrative Consent Order (ACO), issued September 1, 1981, required LCP to submit an application for a hazardous waste facility permit to operate the roaster unit. On June 30, 1982 the Bureau of Hazardous Waste Engineering denied the permit and LCP subsequently abandoned the process. Since the permit was not approved, LCP was also required to close the Brine Sludge Lagoon under the September 1, 1981 ACO.

Closure Plans for the two lagoons were submitted by February 1983 and approved on November 7, 1983. During the Closure of the lagoons, LCP closed down the production facilities in order to eliminate employee exposure to mercury. The closure of the lagoons was completed in 1984.

In June of 1984, LCP submitted a facility closure plan to NJDEP. This included the complete closure of all production areas due to economic reasons. The closure was completed in 1985. Since the closure of the production areas, LCP has operated as a storage and transfer station for methylene chloride, potassium hydroxide, sodium hydroxide and hydrochloric acid that is produced by other LCP facilities. The caustics and methylene chloride are stored in above ground tanks (five tanks, maximum volume 122,800 gallons). Hydrochloric Acid is pumped directly from tank cars to tank trucks.

Operations conducted by Union Carbide include the bottling, storing and transferring of hydrogen. They compress liquid hydrogen to hydrogen gas, bottle it and ship it to their clients. Occasionally they produce gas mixtures of hydrogen with either argon or nitrogen.

Union Carbide has had two environmental releases. One was an air release, which occurred on September 15, 1988 when a safety valve blew off a truck causing a release of hydrogen gas (60,000 cubic feet). The other was a series of oil releases that occurred over a period of several years. The soil contamination was reported by Union Carbide on October 14, 1987 to NJDEP's Division of Hazardous Waste, Metro Bureau of Enforcement. Union Carbide was issued a Notice of Violation (NOV) on December 1, 1987 for the discharge of a hazardous substance. They responded to the violation by contracting IT Corp to excavate the oil contaminated soil near their past waste oil storage area. The soil was excavated and backfilled to conform to the sites topography in May 1988.

Also in 1988, Union Carbide underwent a plant upgrading that was overseen by IT Corp. This included the dismantling of a hydrogen tank, cleaning and replacing of compressor parts and pipelines. A small amount of mercury was recovered from the area of the hydrogen tank by IT Corp.

Microcell Technologies Inc. is a pilot plant that produces small, hollow glass spheres that are used as a strengthener in steel. Microcell does not store, treat or process any hazardous substances. They have a completely closed cooling system so there is no requirement for a discharge permit. There is no evidence of environmental releases at this site.

Kuehne Chemical Company was contracted by LCP to handle the loading of LCP's products. Kuehne also manufactured sodium hypochlorite and chlorine gas. On January 8, 1981 an NJDEP inspector visited Kuehne and had noted a violation in their NPDES #NJ0027707 discharge to surface water permit. Kuehne's discharge had both high and low pH levels and elevated levels of free chlorine. On October 7, 1981 NJDEP Division of Water Resources issued an Administrative Penalty Assessment against Kuehne for $17,500.00. Kuehne ceased operations at the site on January 27, 1981.

LOCAL DEMOGRAPHICS:

LCP is located on 26 acres of filled marshland in the city of Linden, Union County, New Jersey. The property is located in an industrial area along the Arthur Kill. The site is bordered by the Kill (to the east), GAF Corp. (to the west and north) and Linden Roselle Sewage Authority and Northville Industries Corp. (to the south). Densely populated residential areas are located approximately 1.5 miles to the west with the nearest residential home being approximately 0.5 miles west on S. Wood Avenue. The estimated populations living within a one mile and a three mile radius of the site are 7 and 62,000 people, respectively.

TOPOGRAPHY/HYDROGEOLOGY:

According to aerial photographs there are three major topographic changes at the LCP site. Originally S. Branch Creek flowed through the LCP property to the Arthur Kill. Between 1974 and 1977 the creek was damned on both sides of the production area. This resulted in two small ponds on GAF's property. The creek presently flows from LCP's storage tanks to the Kill. The other two changes regard the Chem-fix Lagoon and the Brine Sludge Lagoon.

The Chem-fix Lagoon was constructed and operated in 1976. The Brine Sludge Lagoon was constructed by erecting earthen dikes to contain the sludge in the early 1960's. In 1984, the Chem-fix Lagoon was dewatered, excavated and back filled to conform with the site's topography and the Brine Sludge Lagoon was dewatered and capped closed. The 20 plus years of filling has caused the Brine Sludge Lagoon to be elevated approximately 40 feet above sea level.

LCP is underlain by the Brunswick Formation which consists mostly of organic clays, silt, sand, gravel and a shale bedrock. The first 10 to 15 feet below the surface of LCP is unconsolidated fill composed of silts, sands, gravel, crushed stone and brick. Beneath the fill is a dark gray organic clay layer that extends to the bedrock. Throughout the clay layer there are lenses of sand and gravel. Also between the fill and clay layers there are occasionally peat mats. The red-brown shale bedrock is encountered between 40 and 50 feet below the surface.

The groundwater in this area is not used as a potable water source due to the salt intrusion from nearby coastal waters. There are two public supply well fields within a four mile radius of LCP. One belongs to the Elizabethtown Water Company and is located approximately 3.5 miles northwest of LCP. The other well field is owned by the City of Rahway and located approximately 3.5 miles west of LCP. The wells range from 50 to 350 feet in depth and are all screened in the Brunswick Formation.

LCP monitors its groundwater under NJPDES permit (NJ0003778). The six monitoring wells currently maintained by LCP were installed along the perimeter of the Brine Sludge Lagoon in 1981. The following table lists the well numbers, total depth and screened interval.

WELL NO.	TOTAL DEPTH (feet)	SCREENED INTERVAL (feet)
MW1	38.50	18.00-38.50
MW1A	10.00	5.00-10.00
MW2	39.48	18.00-28.00
MW3	31.77	15.00-30.00
MW4	39.18	18.00-38.00
MW5	38.00	8.00-38.00

LCP currently monitors five of the six wells (not MW1A) to determine the impact of the Brine Sludge Lagoon on the groundwater. Past monitoring reports have indicated that groundwater quality criteria had been exceeded for iron, manganese, total organic halogens (TOX), arsenic, cadmium, chromium, lead, mercury, selenium, silver and radium. During RCRA Facility Assessment visual site inspections (VSI) conducted by NJDEP Bureau of Planning and Assessment on December 20, 1987 and April 13, 1989, the presence of volatile organic (VO) vapors were detected in headspace of Monitoring Wells 1, 2, 3, and 4. The wells are sampled quarterly for total organic carbon (TOC), TOX, phenols, dissolved metals and a few other inorganics.

LCP was required to install four new monitoring wells under their final NJPDES permit issued on October 30, 1987. LCP wished to contest the well installation and requested an adjudicator hearing on February 25, 1988. On March 28, 1988, Donald DeNoon and Karl DeVoe of LCP, Michael McEachern of Geraghty and Miller, LCP's hydrogeologic consultant, and representatives of the Division of Water Resources (DWR) met to discuss the installation of new wells and the adequacy of the present monitoring system.

The DWR had three concerns with the present monitoring system. They were:

- The well screens are not all the same length and the wells are not all the same depth.

- A release from the facility might be diluted to a concentration below the detection limits.

- A leak from the lagoon might be moving above the main groundwater system as "perched water" because of the natural glacial deposits beneath the lagoon are low in permeability (G & M proposal 5/10/88).

To address these concerns Geraghty and Miller proposed that the wells be monitored with the use of a temporary "packer" or plug that would isolate the top five feet of screen that is below the water table. The DWR agreed that the study should be conducted.

In July and August 1988 Geraghty and Miller collected groundwater samples and analyzed them for antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium and pH. The samples collected on July 27, and August 30 were conduted with the use of a temporary packer and the August 29 sampling was conducted without the use of the temporary packer. MW1 and MW1A did not utilize a packer during the July 27 and August 30 sampling. This is because MW1A is a shallow well and MW1 was filled with sediment isolating only the top four feet of screen below the water level. The analysis indicated that MW1A exceeded the New Jersey Groundwater Quality Standard of 50 ppb, for arsenic, with levels of 73 ppb, 76 ppb, and 96 ppb. All other parameters monitored were below New Jersey Groundwater Quality Standards (NJGWQS) for all samples from all wells.

A comparison of the analytical results for wells sampled with a packer (July 27) and without a packer (August 29 & 30) revealed no significant differences, except in MW2, which exhibited an increase in barium when the packer was utilized. The concentration without the packer was 390 ppb while the concentrations with the packer were 750 ppb and 670 ppb. All concentrations were below the NJGWQS limit of 1,000 ppb. Mercury was detected only in MW1A. The concentrations for all three sampling dates were nearly identical; 0.58 ppb, 0.57 ppb, and 0.58 ppb. Again all of the concentrations were below the NJGWQS limit of 2 ppb. Also, a trace amount (8 ppb) of lead was detected in MW3 on the July 27 sampling round. Lead was not detected in any of the other wells or during either of the August sampling episodes. The lead concentration was below the NJGWQS limit of 50 ppb.

These analyses lead Geraghty and Miller to conclude that since there was no significant differences, except for barium in MW2, that there is no dilution occurring in the deep wells. Also, based on data provided by LCP, it has been determined that LCP has never used arsenic, therefore, the presence of arsenic is due to an outside source of contamination. The relatively invariant contaminant concentrations and the proximity of the well to the Arthur Kill suggest that the mercury and arsenic detected in the well represent background conditions in the Arthur Kill rather than contamination resulting from the LCP facility. (G & M January 89 Sam Report).

As of April 1989, the DWR had not yet reached a decision as to whether LCP would be required to install the additional monitoring wells. They also are considering amending the permit to include an analysis of volatile organics based on the findings of the December 22, 1987 VSI.

SURFACE WATER:
The surface waters of concern are the Arthur Kill, which borders the site on the east, and South Branch Creek, which flows through a section of the site and is a tributary to the Arthur Kill. The Arthur Kill is classified as "Saline Estuarine Waters: SE2" by the DWR and is used for recreational boating. The Peregrine Falcon, an endangered species, is known to hunt in the salt marshes near the Kill.

LCP operates a waste water treatment plant. When the plant was in full operation the waste waters from the electrolysis and sludge roaster as well as the plant's surface water run-off were treated and discharge to South Branch Creek under NJPDES permit NJ0003778. However, since the shut down of the plant's processing units, only surface run-off is treated. After treatment, the water is stored in an above ground tank. Due to the small amount of treated water, LCP discharges about two times a year.

From May 23 to May 26, 1988, Cosper Environmental Services Inc. performed a bioassay on LCP's effluent. The effluent samples collected were clear with no noticeable odor. There was a small amount of sediment present. The test organism for the bioassay was the sheeps-head minnow. There was no detection of the disease in the brood stock. For this bioassay, there was a 5.0% mortality at 100% effluent. The results were satisfactory with a LC50 of >100% effluent.

II. PERMITS:

1. NJPDES: LCP was issued a surface water discharge permit NJ0003778 on August 10, 1987, which expires April 30, 1991. The permit allows LCP to discharge treated surface run-off and spill wash-down to South Branch Creek (classified SE-3).

   LCP was issued a groundwater discharge permit NJ0003778 on October 30, 1987, which expires November 29, 1992. The permit requires LCP to continue to monitor the wells surrounding the closed Brine Sludge Lagoon in order to determine the impact of the lagoon on the groundwater.

2. Air: Currently LCP has a grandfathered air pollution control permit #076565, which is for the vents on their methylene chloride storage tanks. Previously LCP had eight air permits for hydrogen chloride tanks and several chlorine process apparatus. Due to the closure of the production areas at LCP, these permits have been deleted.

3. LCP submitted their Part A RCRA application on August 13, 1980. Since the only RCRA regulated unit was certified closed in September 1985, a Part B application was considered unnecessary in lieu of a post closure permit.

III. SOLID WASTE MANAGEMENT UNITS:

Twelve solid waste management units were identified at the LCP facility. The units are: The Brine Sludge Lagoon, the Chem-fix Lagoon, the 500K Tank, the Waste Oil Drum Storage Area, Area Between Building 231 and Railroad Tracks, South Branch Creek, the Bullet Tanks, Sludge Roaster, Salt Silo 4, past GAF Waste Water Treatment Area, the cracks in Building 230 and 240, and the Effluent Treatment Building. The only RCRA regulated unit is the Brine Sludge Lagoon.

UNITS SUMMARY:

1. Brine Sludge Lagoon: The lagoon is an unlined earthen surface impoundment, which is surrounded by earth dikes that extend about seven feet higher than the facility's average ground level. The lagoon is trapezium in shape, approximately 275 feet by 200 feet by 220 feet by 80 feet. The total waste volume is estimated to be 30,900 cubic yards, which was accumulated for over 20 years before the lagoon was closed in 1984.

   Under an Administrative Consent Order dated September 1, 1981, LCP agreed to submit a closure plan to the NJDEP for the lagoon. LCP submitted the plan on July 16, 1982. The plan was amended on February 28, 1983 and approved by the NJDEP on November 7, 1983. The lagoon received the excavated waste from the Chem-fix Lagoon, which was dewatered, compressed and covered with a two foot clay cap. The cap was then covered with a foot of soil and seeded. The closure was completed in November 1984. During the closure of the lagoon, NJDEP and USEPA required LCP to suspend chlorine productions to eliminate worker exposure to mercury.

In 1981, LCP installed six monitoring wells to determine if there was any impact on the groundwater from the lagoon. These wells are sampled quarterly for TOC, TOX, phenols, dissolved metals and a few other inorganics. On several occasions between 1982 and 1987 quarterly reports indicate that concentrations of lead, chromium, cadmium, mercury, selenium and silver have exceeded the NJPDES permitted level.

Under the July 31, 1981 NJDEP Administrative Consent Order, LCP was required to implement a monitoring program to evaluate the release of mercury and other metals to the ambient environment. The program includes air, groundwater and soils obtained from land borings and creek sediments. Geraghty and Miller were retained to conduct all sampling except air. Recon Systems was contracted to perform air sampling. (Attachment B).

Recon collected two sets of sampling data on June 4, 1981. The first set of samples was collected three feet above the surface of the waste pile. Concentrations of mercury ranged from 1000 to 5000 nanogram/cubic meter (ng/m^3) to 12,600 ng/m^3 of mercury with an average concentration of 6400 ng/m^3. Based on the mercury contamination levels, crosswind speed and the lagoons dimensions an approximately 113 g/day of mercury is emitted by the lagoon.

Groundwater samples were taken on October 6, 1981 and October 15, 1981 and analyzed by LCP's lab for dissolved mercury. All samples were below the USEPA Primary Interim Drinking Water Standard of 0.002 ppm. The water samples were also sent to Princeton Testing Labs to be analyzed for calcium, barium, iron and mercury. Again all wells had levels below 0.002 ppm for mercury. However, the levels of barium ranged from 2.0 ppm to 7.0 ppm which exceed the NJDEP Action/Cleanup Level of 1 ppm.

Soil samples were taken from the monitoring well borings for MW1, MW2, MW3, MW4, MW5. The samples were analyzed by LCP for desorbable mercury with samples taken every 6 inches from the surface to the total depth of each well. Levels of mercury ranged from 0.26 ppm to 772 ppm, with the concentrations decreasing with depth. Surface soil samples were also taken near the sludge roaster and across Avenue B near the railroad tracks. The samples were analyzed in the same manner as the previous samples and had recorded levels of mercury ranging from 27.45 ppm to 1,580 ppm. Also, one creek-bed sediment sample was taken and analyzed by LCP for mercury. The sample contained 46.42 ppm of mercury. All of the surface samples exceeded the NJDEP Action/Cleanup Level of 1 ppm for mercury.

On April 13, 1989 the Bureau of Planning and Assessment (BPA) conducted a RCRA Visual Site Inspection (VSI) of the LCP facility. The closed lagoon appeared secure. During the investigation of the monitoring wells, volatile organics were detected in the headspace of the wells by both the OVA and Hnu meter with readings ranging from 2 ppm to 350 ppm. Also, on a previous VSI conducted by the BPA on December 22, 1987, organic vapors were detected in MW1 and MW2 with the Hnu meter. Due to the presence of organic vapors in the headspace of the wells, it is recommended that the NJPDES 30 year post closure monitoring program be expanded to include an initial scan for priority pollutants and volatile organics. Due to the presence of mercury contamination, a RFI is recommended for this unit to determine the extent of the contamination. The RFI should consist of soil sampling around the perimeter of the lagoon to determine if any hazardous materials have leached from the lagoon. The sample analysis should include, but not be limited to, total mercury, total barium, volatile organics and priority pollutants. If this sampling indicates significant levels of contamination exist, a more detailed RFI is recommended.

2. The Chem-fix Lagoon: The Chem-fix Lagoon was an earthen surface impoundment which was in operation for a few months in 1976. The lagoon dikes were constructed to a height of eight feet with an earthen core and crushed stone cover. Two 0.20 mil thick visquene plastic liners were installed in the lagoon which was also equipped with a perforated under drain system for leachate collection. Any leachate collected was pumped to the effluent treatment plant. The lagoon received approximately 460 cubic yards of treated brine sludge.

   The Chem-fix Lagoon was closed in 1983. The contents of lagoon were excavated and placed into the Brine Sludge Lagoon. It was then back filled, graded and seeded. The proximity of the Chem-fix Lagoon to the Brine Sludge Lagoon allows the NJPDES permitted wells to monitor any leachate releases to the groundwater from either lagoon. During the VSI an April 13, 1989, the lagoon appeared secure and there is no evidence of releases. Due to the proximity of this lagoon to the Brine Sludge Lagoon and the potential to have received mercury waste; a limited RFI is recommended. The RFI should consist of soil sampling to determine if hazardous wastes have leached from the lagoon. The sample analysis should be identical to the analysis of the Brine Sludge Lagoon.

3. The Waste Oil Drum Storage Area: The Container Storage Area is a 300 square foot concrete pad, one foot thick, with a six inch curb. During full plant operations up to 40 (55 gallon) drums of waste lubricating oils, transformer oils, degreasing solvents, and dewatered brine sludges could be stored there. These wastes were shipped off-site for proper disposal within 90 days.

   During the December 22, 1987 VSI, there were no drummed waste being stored, however the pad was covered with an absorbant material and oily residues were noted on the gravel in the surrounding area. During the April 13, 1989 VSI, stained soils were also noted. Using air monitoring equipment (Hnu and OVA), organic vapors were detected in the soil (10 ppm on the OVA and 6 ppm on the Hnu). It is recommended that a RFI be conducted on this unit to determine the extent of the release. The RFI should consist of soil sampling and the analysis should include, but not be limited to, petroleum hydrocarbons, volatile organics, total mercury and priority pollutants. Based on the results of the soil sampling it may be required that the groundwater be monitored.

4. Area Between Building 231 and Railroad Track: In August 1980, NJDEP was contacted by a LCP employee. The employee stated that one day in 1973 or 1974, LCP used a steam shovel to take some of the brine sludge from the lagoon and spread it on the ground behind the compressor building (#231). In 1981, during the Geraghty and Miller sampling episode, two surface soil samples (S-3, S-4) were taken near this area. The samples were analyzed for desorbed mercury. The results were: S-3, 1070 ppm and S-4, 1580 ppm of mercury. These levels of mercury are the highest detected in any sampling conducted on the LCP site. These concentrations are 300 ppm greater than the soil samples near the Brine Sludge Lagoon. Due to the presence of mercury contamination, a RFI is recommended for this unit to determine the extent of the contamination. The RFI should consist of soil sampling which includes, but not be limited to, total mercury and priority pollutants. If the results of the soil sampling indicate significant contamination, further investigation will be necessary to determine the extent.

5. 500K Tank and Surrounding Areas: The 500,000 gallon tank is located between Avenue C and Avenue B. The tank has served two purposes. Originally the tank was used to store sodium hydroxide and later became incorporated with the effluent treatment system and was used as a storage tank for wastewater. Presently the tank is not used. The area surrounding the tank was paved in 1982.

   From 1980 to 1982, a series of NJDEP Hazardous Waste Enforcement inspections revealed several releases in the area of the 500K Tank. The releases in this area are:

   9/17/80 Brine Sludge was observed on the gravel near the 500K "collection tank."

   1/21/81 During the inspection a liquid was observed spewing from a cracked PVC pipe near the 500K Tank and pump pit.

   10/22/81 A brine sludge slurry release from a transfer line was evidenced by a 1 by 15 foot spill area located on Avenue B between the pump pit and the Brine Sludge Lagoon. There was also a hydrochloric acid spill approximately 15 feet northwest of the 500K Tank.

   4/13/82 Sodium sulfide crystals were evident on the gravel surface in the pump pit area.

   Due to documented releases, a limited RFI is recommended for this unit. The RFI should consist of soil sampling and the analysis should include, but not be limited to, total mercury, hydrochloric acid, sodium hydroxide, sodium sulfide, and priority pollutants. A more in-depth RFA may be required based on the results of the soil sampling.

6. South Branch Creek: South Branch Creek is a tidal arm of the Arthur Kill that flows along the eastern border of the LCP property. Since

1974, LCP has had three discharges to the creek. On or about October 30, 1972 and February 7, 1974, there was an overflow of supernatant in contact with brine muds from LCP's Brine Sludge Lagoon into South Branch Creek. LCP pled guilty to violation 3 USC 1311 (a) for both occurrences on September 25, 1975. A fine of $5,000 was levied for each occurrence. The third incident occurred on August 15, 1979. Due to a sodium chloride block in LCP's east saturator an excess of mercury tainted brine overflowed the saturator. The surge of flow exceeded the surge capacity of the wastewater system. This caused an estimate of 10,000 to 20,000 gallons of brine to flow into South Branch Creek. LCP notified NJDEP and the EPA samples taken by the Coast Guard revealed the mercury contamination of the spill was 8.6 ppm.

In 1981, a sediment sample was taken from the creek. The sample was analyzed by LCP's Labs for mercury. The mercury concentration was 46 ppm, which exceeds NJDEP action/clean-up level of 1 ppm. Due to past releases to the South Branch Creek a limited RFI is recommended for this unit. The RFI should consist of sediment sampling and surface water sampling both upstream and downstream of LCP's discharge (DSN 001). The sample analysis should include, but not be limited to, total mercury, barium and priority pollutants.

7. Bullet Tanks: These tanks have been abandoned since about 1983. The Bullet Tanks were used to store brine sludge. A series of NJDEP Hazardous Waste Enforcement inspections have revealed that there were continual problems with brine containment in the area under the tanks. From September 17, 1980 until April 13, 1982 the inspections stated that the containment area had brine residues. On October 9, 1980 and January 22, 1981 the area was full with the potential to overflow.

   Due to the potential for a release to exposed soils a limited RFI is recommended for this unit. The RFI should consist of soil samples around the bermed area of the abandoned Bullet Tanks. The sample analysis should include, but not be limited to, total mercury, acid-base extractables and priority pollutants. Based on the results of the soil sampling it may be required that an additional investigation be conducted.

8. The Sludge Roaster: The Sludge Roaster was constructed in 1978 to vaporize mercury from steam dried brine sludge. The roaster was built on a 16 x 40 foot concrete pad, one foot thick, with drain channnels, that connect to the effluent treatment plant, and a cinder block curb around the pad.

   Under an Administrative Order issued on September 1, 1981, LCP was required to submit an application for a Hazardous Waste Facility permit to operate the roaster unit. The permit was denied on June 30, 1982 by the Bureau of Hazardous Waste Engineering (BHWE) and LCP subsequently abandoned the process.

   An enforcement inspection by the Division of Environmental Quality, Air Pollution Control Program on November 5, 1981 disclosed a hole in a muffler plate on the sludge roaster. This allowed an excessive quantity of mercury vapors to be released to the atmosphere.

In 1985, the sludge roaster was dismantled and most of its components were shipped to other LCP facilities. No further action is necessary for the roaster unit, at this time.

9. Salt Silo 4: This silo was used to store the brine sludge prior to disposal in the lagoon. During the October 9, 1980 inspection brine sludge was observed on the ground around the silo. The silos were removed in 1985. A limited RFI is recommended on this unit due to the potential of releases to the soil. Soil sampling should be conducted and the analysis should include, but not be limited to, total mercury and priority pollutants. An additional investigation may be required based on the soil results.

10. The Effluent Building : This building was originally used as a brine filtering facility. LCP began wastewater treatment in this building around the time of the lagoon closures. The October 9, 1980 inspection indicates that there was brine caked on the floor near the filters. This was washed to the sump next to the 500K Tank and eventually treated. Because there are no documents of a hazardous release from this area, no further investigations are warranted at this time.

11. Past GAF Waste Water Treatment Area: From past GAF and LCP site maps it appears that the waste water treatment plant that was operated by GAF was located on the western side of building 220. It is believed that the plant was used primarily for pH neutralization from the 1950's to the early 1970's. The site presently is paved over and supporting a transformer substation. No further investigation is warranted at this time.

12. Cracks in the Floor of Building 230 and 240: The employee complaint also stated that because of Occupational Safety and Health Administrative visits LCP re-cemented the floors of Buildings 230 and 240 to cover cracks. According to the employee these cracks may have exposed soils that could have been contaminated with mercury. The employee felt that this was not investigated by LCP.

In 1976, OSHA inspected the buildings and did report openings in the floor and wall of these rooms. However, there was no indication of possible soil contamination with mercury.

OSHA also conducted a health survey in April 1985. This survey concluded that any workers in Buildings 230 and 240 are exposed to mercury and mercury vapors above the OSHA 8 hr-time weighted average permissible exposure limit. According to the Plant Manager, John Canonton, LCP still monitors for mercury vapors and worker exposure even though they no longer produce chlorine.

Due to the potential of soil exposure to mercury, a limited RFI is recommended for this unit. Soil sampling should be conducted and the analyses should include, but not be limited to, total mercury and priority pollutants.

<u>ADDITIONAL CONCERN</u>:
The 1982 Waste Lagoon-Ground Water Monitoring Report submitted by Geraghty and Miller stated that a possible source for the mercury

contamination at LCP was due to contaminated fill. There are three conditions which suggest that this is not the case. The data presented in the report indicate that soil samples below the fill layer have levels of mercury exceeding 1 ppm, the NJDEP action level. Based on the history of the site, the soils at GAF and LCP should have a similar composition. However, soil sampling conducted at GAF by NJDEP Bureau of Planning and Assessment, in December 1988 (data not reviewed for QA/QC), indicated lower mercury levels than LCP. GAF had levels of mercury ranging from <0.1 ppm to 347.8 ppm (Ave 29.1 ppm) and the levels of mercury for LCP ranged from <0.1 ppm to 1,580 ppm (Ave. 102.4 ppm). The highest levels of mercury 1,070 ppm and 1,580 ppm are in the area of alledged surface dumping, it is likely that this is a probable cause of mercury contamination. It is suggested that if the recommended soil sampling yields mercury levels similar to those of 1982, LCP should submit a remedial plan to address the contaminated soil.

IV. RECOMMENDATIONS:

A. The following have been determined to have no further action:

1. Sludge Roaster
2. The Effluent Building
3. The Past GAF Waste Water Treatment Plant

B. Units requiring a limited RFI based on known or strongly suspected release of contaminants to the environment.

1. The Chem-fix Lagoon
2. The 500 K Tank
3. South Branch Creek
4. The Bullet Tanks
5. Salt Silo 4
6. Cracks in Building 230 and 240

C. Due to the presence of mercury contamination, a RFI is recommended for the following units.

1. Brine Sludge Lagoon
2. The Area Between Building 231 and the Railroad Tracks
3. The Waste Oil & Drum Storage

All actions taken by the USEPA should be integrated with previous and ongoing actions by NJDEP.

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RFA HOURS: 230

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